SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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THE IRON AND STEEL INSTITUTE.

The retrospect of the progress made in metallurgical and manufacturing operations during the thirteen years that have elapsed since he Iron and Steel Institute was first founded, given at the annual meeting in the inaugual address of the new President—Mr. B. Samuelson, M.P., F.R.S.—contained an unusually large amount of interesting information. He remarked that during this interval 250 papers had been read and discussed by the Institute, of which 50 had been contributed by foreign members. Within the same period the world's production of pig-iron had increased from 10,000,500 tons to 20,000,500 tons; the weekly production of blast-furnaces had been increased from 180 tons to a production of 850 tons per week in the Consett furnaces, and of 1220 tons per week in some furnaces on the other side of the Atlantic. The great increase in the production of pig-iron had been accompanied by a very considerable saving in fuel, which could not be put at much less than one-third of the entire consumption of coal required to produce a ton of pig-iron in 1869. Referring next to improvements that had been realised in the manufacture of coke, the President noticed that in the ordinary beehive-oven the average percentage of coke was only 60, whereas in certain oblong ovens erected at the President's collieries in Durham and in the new ovens on the Carvé's system erected by Messrs. Pease, the percentage of coke had been raised to 75 and even 77, concurrently with which the by-products had been utilised to the extent of 7 gallons of tar and 30 gallons of ammonical liquor per ton of coal, the value of these by-products being 4s. 3d. per ton of coal. Against this there was a charge of 1s. 4d. per ton of coke for additional labour and the interest on the first cost of the plant, which was considerable. A third improvement had been introduced at the collieries of Messrs. Bell Brothers, where oils of various specific gravities (some of which were said to be very rich in paraffin) were separated from the coke, as well as the ammonical liquor, by what is known as the Jameson process; and analyses of the crude oil obtained by this process showed that in every 100 parts there was 26 to 31 per cent. of wax oil. It was proposed to apply the principle of the latter process to the recovery of oil and ammonia from the smouldering waste heaps at the pit-bank.

These various methods of utilising valuable products which were at present lost would, in Mr. Samuelson's opinion, tend to lessen the cost at which iron could be produced, and still further to increase its consumption. The increased make of pig-iron since 1869 was largely accounted for by the increase in the world's railways, which had advanced from 155,000 miles in 1872 to 260,000 miles in 1882, and by the enormous increase in the production of iron ships, the quantity of iron used for the latter purpose being estimated at 1,000,000 tons of pig-iron for 1882, which would not be far short of four times the quantity so used before 1870. In 1869 the world's production of Bessemer steel would be about 400,000 tons; last year it was over 5,000,000 tons, and it had doubled in every steel-producing country except France during the last four years. Not less remarkable was the great diminution in the cost of Bessemer steel, which fluctuated between 10*l.* and 18*l.* per ton in 1875, steel rails having been sold within the last four years at 4*l.* 10s. This great reduction was the cumulative result of a number of concurrent improvements, partly in the conversion of iron, and partly in the subsequent treatment of the ingot steel. After referring to the more important of these improvements, the President went on to remark as to the enormous importation of iron ore into this and other iron-producing countries, and mentioned that Great Britain alone imported 3,000,000 tons of high-class iron ore during last year. Referring to the basic process, the President said that the present production of basic steel in this country and on the Continent was at the rate of considerably over 500,000 tons per annum. In the case of the Siemens-Martin process of making steel equally great developments had taken place. Before 1870 no works possessed furnaces capable of containing more than 4-ton charges, producing ingots of about 6 cwts. At the present day we had furnaces of 15 to 25 tons capacity, and by compounding several furnaces single ingots, weighing from 120 to 125 tons, had been produced at the Creusot Works. The production of open hearth steel in 1872 was from 800,000 to 850,000 tons. In reference to wrought-iron the world's production had increased from 5,000,000 tons in 1869 to over 8,000,000 tons in 1882. Although little had been done in the interval in the way of improving this branch of the iron manufacture, some excellent results had been obtained by the use of the Bichereux gas-furnace in Belgium, where the consumption of coal per ton of ordinary puddled bar had been reduced to less than 11 cwts., while the puddlers earned from 25 to 30 per cent. more at the same tonnage rate. Referring to shipbuilding, the President stated that the gross tonnage of the iron vessels classed during 1882 by the three leading classification societies was 1,142,000 tons, and of steel 143,000 tons. The proportion of steel to iron vessels was increasing from year to year. The rails, hammers, and the machinery for punching, planing, &c., used in the manufacture and preparation of the plates and angles for shipbuilding and armour plates were to be on a scale far different from what they were in 1869. Perhaps the most striking examples of powerful machinery for these purposes were the great Creusot hammer, the falling mass of which had recently been increased to 100 tons, and the new planing-machines at the Cyclops Works, which weighed upwards of 140 tons each, for planing compound armoury plates 19 in. thick and weighing 57 tons. The President proceeded to refer to the various directions in which it was necessary to look for the future support of the iron trade, and quoted, as a instance of this, the further development of the world's railways, and, in conclusion, he adverted to the amicable relations established between capital and labour by boards of arbitration and conciliation, and the increased estimate of the value of science entertained by our practical men.

The award of the Bessemer medal to Mr. G. J. Snelus, A.R.S.M., of Workington, will be recognised as fully justified by many besides the members of the Iron and Steel Institute, since it was unquestionably the investigations of Mr. Snelus which rendered the invention of the Thomas and Gilchrist process practicable. The award being made to Mr. Snelus conjointly with Mr. Thomas, will indelibly, and very properly so, connect Mr. Snelus's name with the invention in all future histories of the metallurgy of iron and steel. In acknowledging the honour conferred, Mr. Snelus recounted the manner in which he had been induced to make a study of the science of metallurgy. He gratefully recognised the assistance he had received from the late Mr. Menelaus when at Dowlais, where he had worked out the theory of the basic process, which had been matured by Messrs. Thomas and Gilchrist, with the assistance of Mr. E. Windsor Richards. He expressed a hope that the encouragement offered by the Institute would be an incentive to the plodding student in attempting to unravel the many secrets of Nature which were still locked up and were yet to be discovered.

The Chemical Composition and Testing of Steel Rails brought before the Institute for the first time in the paper by Mr. G. J. Snelus was next discussed. It was mentioned that the question has been widely discussed both in America and on the Continent of Europe, and the opinions expressed with relation to it both by metallurgists, whose business it is to furnish the materials for the construction of the rails, and by engineers, who prescribe the composition of the tests to be borne by the rails, are very divergent. Mr. Snelus's paper dealt elaborately with the history of the question up to the present time, especially criticising an ideal composition for steel rails as prescribed by Dr. Dudley—the chemist of the Pennsylvania Railway Company—a composition which had been adopted by most of the railroads of America. With the composition laid down by Dr. Dudley Mr. Snelus did not agree, and he contended that the steel rails should contain not more than ·35 of carbon, ·1 of silicon and ·075 of phosphorus. The second portion of the paper described those methods for testing steel rails which were, at the present time either in actual use, or were suggested and under notice. Of these the more important were the examination of the fracture of the rail, chemical analysis, and the falling weight test, the latter being commended by the author of the paper as probably the simplest and best mode of testing steel, as the inspector was enabled to make his tests with rapidity upon the full section of the rail. The test, when reasonably executed, approximated in a great degree to the effect produced upon the rail when in actual use, discriminating in an infallible manner between good and bad rails. Tests were, however, often specified by engineers far in excess of anything that a rail would be called upon to bear, and the effect of this frequently was to lead to the rejection of perfectly good rails. The paper also dealt with lever tests by rupture, torsion tests, and punching tests, and concluded with a tabulated statement of the methods of testing required by the principal railway companies as well in England as abroad. Since the paper was written the results of a test had been obtained which Mr. Snelus was enabled now to embody. A suggestion had, he remarked, been made that the inspector ought to take a section of the rail, and apply to it the centre punch under certain pressure, and by the amount of indentation which was shown the hardness of the rail could be discovered. From experiments made since the paper was written he had found that this centre punch test would be capable of determining within certain limits the stability of the rail, and this would furnish a means of testing the rails during the progress of manufacture.

The substitution of steel for iron in construction formed the subject of the two succeeding papers, which were taken together. The first was by Mr. W. Parker, of Lloyd's, on the use of Steel Castings in lieu of Iron and Steel Forgings for ship and marine engine construction, in which he stated that the committee of Lloyd's Register, after careful consideration, had arrived at the conclusion that cast steel might advantageously be used in place of wrought iron, its use being free from the uncertainty which invariably attended large iron forgings, owing to the weldings required in the latter. Several firms had successfully manufactured steel castings, but there was considerable diversity of practice, and among manufacturers themselves there was far from unanimity upon the question of large forgings, both in iron and steel, and the writer pointed to various methods as to which there was difference of opinion. As a result of the substitution of steel for iron at many forges, better and more reliable ships than formerly had been turned out, some, indeed, being superior to the best of iron ships; and to this fact was due the adoption of steel by so many eminent shipbuilding firms. The author had appended to his paper a number of tables, showing the results obtained by testing cast and forged steel and iron, having in view the object of determining their relative fitness for the purposes in question. These experiments showed that on the average cast steel was fully one-third better than wrought iron, while the results obtained from the use of forged steel were three times as good as when wrought iron was in question. The second paper was on Bessemer Steel in its cast and unwrought state, by Mr. W. D. Allen, of Sheffield, who contended that Bessemer steel was of the utmost value in its simple cast condition, though its importance as a certain and reliable material for castings had not, as yet, been fully recognised, owing, to a great extent, perhaps, to the fact that it had been largely used in the manufacture of iron rails, and there was a danger that that might be its ultimate destiny. He had found from experience, however, that Bessemer steel might be advantageously employed for every purpose, however great or small, to which steel was capable of being adapted, and this advantage was greatly enhanced by the use of the agitator which got rid of the evil effects of bubbling. In the course of the discussion which followed Mr Riley pointed out that crucible steel was more homogeneous than Siemens-Martin steel, whilst Mr. Hall (of Jessop and Sons) thought that it was very nearly as reliable for large castings as what could be obtained in the crucible. For small castings he did not think there could be any doubt that the crucibles could beat the open air furnace. He did not believe in making castings by the Bessemer process, for he did not think it was at all adapted to that purpose. It was admitted by Sir Henry Bessemer that there were few views entertained by practical men that were not founded on fact, and that applied to the popular prejudice with regard to the bubbling in the Bessemer process, a respect in which the other modes had an advantage. A complete remedy for this bubbling, however, had been found in the agitator, which caused the chemical action to take place with a violent rapidity, having the effect of getting rid of the gas and giving a sound casting. The experience of Sir C. W. Siemens was that the act of forging produced very great evil, and there was a great advantage in favour of casting where changes of dimensions occurred. Recognising the worth of the quality in steel of bending before breaking, he thought that the steel should be of the mildest possible description.

The manufacture of pig-iron received the largest share of attention in the second day's proceedings, no less than three of the papers read bearing upon that subject, the economising of fuel by the superheating of the blast being the principal question dealt with. In a paper on the Comparison of the Working of Blast Furnaces with blast varying from 990° to 1400° Fahr., Mr. Hawdon, of Middlesborough, stated that the experiments by which the comparison was arrived at were made with a furnace belonging to Messrs. Samuelson and Co., in Middlesborough. The 990° were obtained by the ordinary iron-pipe stoves, and the 1400° by Cowper's fire-brick stoves a few hours after the former had been cut off. The circumstances in which the experiment was made thus gave an accurate means of comparison. The result of the increased temperature was a saving of 1½ cwt. of coke per ton of iron, an increase in economy of 60 tons per week. The quality of the iron was also better by nearly one quarter on a grade without any greater reduction in silicon: 2500*l.* each was the price of the Cowper stoves, which meant 4440*l.* per furnace, giving, according to Mr. Hawdon's calculation, 1018*l.* as the total cost saving per annum, with a saving of gas and a profit on the extra manufacture. In a paper on the Value of Successive Additions to the Temperature of the Air used in Smelting Iron, Mr. I. Lowthian Bell stated that his experience induced him to question whether there was any advantage in heating the blast above 1000° when the furnace was of sufficient capacity; and if there was any saving it must be very insignificant compared with that which Neilson achieved by the first application of the heated air. A third paper, on a New Hot-blast Fire-brick Stove, by Mr. Thomas Massicks, read at the Vienna meeting of the Institute, was laid on the table, so as to be included in the discussion, in the course of which Mr. Richards said he was acquainted with the qualities of both iron-pipe stoves and fire-brick stoves, and his opinion was in favour of the latter. He had found that there was no economy in the larger furnace. Mr. Martin stated that Blaenavon an old cast-iron stove was attached to two Cowper stoves, with the result that, after five weeks' working, the consumption of coke fell from 24 cwts. to the ton to 19 cwts., thus giving a saving of 5 cwts. Mr. G. J. Snelus thought the quality of the coke in the furnace ought to be taken into consideration more than was the case. The President and Messrs. R. Stephenson, Bell, Cochrane, and Hawdon also took part in the discussion. The day's proceedings were brought to a close by the reading and discussion, by Mr. W. H. Butlin, B.A., on the Northamptonshire Iron Ore District, in which he gave a sketch of the general features, position, extent, &c., of the mineral deposits of the county, with their development in establishing the important industry of producing copper ore, and the subsequent treatment of the material in the blast furnace in the course of the manufacture of pig-iron.

The Production and Utilisation of Gaseous Fuel in the Iron Manufacture formed the subject of an interesting paper read on the last day of the meeting by Mr. W. S. Sutherland, of Birmingham, in which he said that, in 1866, while fitting on a valve feed to a locomotive he had been struck with the idea that if seams of boilers could be welded instead of rivetted there would be an advantage gained in strength and economy which was worth the working out, and he had since carried out this idea successfully. In working out the process there had been some difficulty in obtaining the requisite heat, and applying it economically and of uniform quality and concentration upon the parts to be welded. The smith's hearth did not give perfect uniformity of heat, while ordinary gas was too expensive, and to ensure uniformity of action by its means the gas should be supplied with the requisite oxygen or air in proper and definite proportion. They, therefore, were driven to use coal gas or Siemens gas, and with these they were successful; but they were in want of a good cheap gas having some special qualities, particularly high heating power per unit of volume. The only available solution of this difficulty seemed to be found in the use of gas made by the action of superheated steam upon carbon—water gas. It had been urged with regard to this gas that its poisonous qualities were such as to make its use exceedingly dangerous; but it was the opinion of the author of the paper that it was no more poisonous than coal gas, and from his own experience with producer gas, coal gas, and water gas he was convinced that the hydrocarbons and tarry matters did far more hurt than the carbonic oxide. Compared practically with coal gas, the heating power of water gas seemed one-half, but experience had shown that it might be produced at a cost not exceeding 3d. per 1000 ft.; while for simplicity in using it when made it was far superior to producer gas, and more easily managed.

In making Siemens gas, the higher the temperature at the bottom of the producer the better was the gas made, and the less carbonic acid would there be in it. When coal was made into this gas, the coal tar and water had to be distilled off from the fuel, an operation which required 10 per cent of sensible heat, and 20 per cent. of sensible heat was left for utilisation. This 20 per cent. was utilised by taking the heat down to the bottom of the producer, and making it superheat steam so as to form water gas, which was done by increasing the draught in the producer. By these means the loss of heat from the fuel only amounted to about 7·5 per cent. In these operations the problem was to keep the fuel like a sponge, but without large holes or cavities. With the temperature at a low figure, and the loss by cooling reduced to a minimum, little water was needed to bring it down to the requisite point for condensing effectually the tar and water, with which the writer had had considerable trouble while working with Siemens gas in 1871 or 1872. Machinery had been adopted by several firms for taking the tar and water out of the gas, and it had worked exceedingly well, giving as much as 1½ cwt. of good tar per ton of Staffordshire coal, and ammonia water to the extent of 4° Twaddel, which was equal to 3s. or 4s. saved per ton of coal, and there was reasonable hope that even a greater saving would be effected. Now the production of coal in the United Kingdom during 1882 was 156,499,977 tons; and if from one-quarter of this coal the residuals had been extracted, there would have been at 2s. per ton a saving of 3,900,000*l.* The latter part of the paper dealt at considerable length with different methods of treating iron for welding, and Mr. Sutherland gave it as his opinion that to produce a good true wrought-iron which would weld well, and in all respects take the place of the best puddled iron, it was advisable to use the Bessemer converter or an equivalent vessel, and instead of blowing raw air into it, to blow Siemens gas (which contained an excess of carbonic oxide) along with the air in varying proportions, until at the finish a proper excess of gas was present. To keep the metal fluid with this proper excess gas or air or both should be heated to a sufficiently high temperature before going in, and should be passed in thin streams side by side under the surface of the metal—*i.e.*, through the bottom, sides, or wherever they could be got to go, so that when they came in contact with the metal the mixture might be perfect, and good wrought-iron would be produced.

In the discussion which followed, Mr. Isaac Lowthian Bell said that he believed water gas would be extremely useful for domestic purposes, and it would get rid of a great deal of nuisance consequent upon the conveyance of the coal.

The papers taken as read were—Mr. Fritz Baare, of Bochum, on "Coal Washing Machinery Employed by the Bochum Verein," Mr. Ernest Trubshaw, of Llanelly, on "The Tin-plate Manufacture," and Mr. Albert Riche, on "Improvements in Railway and Tramway Plant." A vote of thanks to the Institution of Civil Engineers for the use of their rooms, and another to the President, concluded the proceedings.

GALVANIC BATTERIES.

In connection with galvanic batteries containing fluid electrolytes, Messrs. EMMENS and MASON, of Soho-square, with a view to obviate polarisation, and render the current constant and of long duration, cause the points of contact between the electrodes and fluids to be changed perpetually, or at suitable intervals, but in such a manner that the total operative surface may remain of constant magnitude. The devices employed may be of various construction. They are made to impart either a rotatory or a reciprocating motion to the electrodes or fluids, or to both, though conveniently in such a manner as to cause an alternate or continuous emerging or submerging movement of the electrodes. This is conveniently effected by mounting the electrodes upon an axis made to revolve by the battery power or by manual or mechanical means, the electrodes being submerged through half or part of a revolution.

The electrodes in this case may be fitted on the axis in the form of discs, or in arms projecting therefrom, and at any suitable angle thereto; they may, however, be in the form of a cylindrical cage of longitudinal electrodes, or one electrode may be on the axis and surrounded by the other. A second modification is where the electrodes are columnar or cylindrical, and in this case they rotate the electrodes or cells or both (in contrary directions) in horizontal plane on a vertical axis, no emergence taking place. A third modification is where they employ reciprocating in place of rotatory motion, and in this case they prefer to attach the electrodes to cross bars oscillating on an axis, so that as one electro emerges another is submerged to an equal extent. They can, however, communicate motion only to the cell, or both the cell and the electrodes may be in motion in opposite directions.

In any modification of our device the electrodes may be coupled in series or multiple arc as desired, by suitable arrangements on the axis. In order that the nature of the invention may be more clearly understood they describe, by way of example, an application of one of its forms to a bichromate battery. They arrange the cells side by side, as customary, and above them place an axis revolving in bearings at each end of the row. On this axis they mount circular plates of carbon and zinc properly insulated in such a manner that a zinc plate between a pair of carbon plates may dip into each cell. These plates, which constitute the electrodes, may be coupled up in a series or in multiple arc along the axis, which must be suitably divided by insulating material, and the current is collected therefrom at the ends or by brush or roller contacts. Rotation is imparted to the axis by suitable driving connections, actuated by a portion of the current from the battery or by other convenient source of power. The electrodes being partially immersed in the bichromate solution in the cells always retain the same operative surface, while by means of the constant change of position and agitation of the fluid, no injurious polarisation is set up, and a steady current of long duration is obtained.

ELECTRIC ILLUMINATION, AND ITS COST.—It has frequently been claimed by inventors and as frequently denied in the *Mining Journal* that with regard to cost electricity is more economic than gas as an illuminant for general purposes, and the statement of the Chairman at the recent meeting of the Electric Lighting, Contract, and Maintenance Company shows the accuracy of the adverse view. He said that the result of all the electric light companies starting was excessive competition. The universal offer was the electric light at the price of gas, but he maintained that that could not be done; at least no system, at any rate, of incandescent lighting with which they were acquainted at the present moment could show that it made a profit commensurate with the risk run. He could quite conceive that a well-managed company, manufacturing its own plant and not overburdened with money expended on the purchase of patents, might pay its way and keep going, but more than that he would not allow. Of course they would understand that these remarks applied only to the present position in connection with the electric light. He could understand that the electric light could be produced at a very considerable profit at New York and on the Continent, where gas was two or three times as dear as it was in this country. They must also remember that the moment the gas companies felt themselves seriously pressed by the electric light companies a large reduction in the price of gas and great improvements in it would inevitably be seen. The directors still believed in the principles upon which the company was founded, and also in the future of electric lighting, but the company had come into the world a little too soon. There can be no doubt that the present method of producing the electric light by the use of gas-engines is as unscientific as it would be to attempt to work a steam-engine by attaching a waterwheel to the flywheel instead of using steam. It will probably be long before the incandescent system can be introduced with economy in any posi-

tion, but with regard to arc lights there is an ample field for them if they be applied only to the illumination of large halls or theatres where a brilliant light and a pure atmosphere are of greater consideration than the cost.

Original Correspondence.

INDIAN GOLD MINING, AND ITS PROSPECTS—No. IV.

QUARTZ OUTCROPS OF TRAVANCORE.

By J. MACDONALD CAMERON, Fel. Inst. Chem., F.C.S., &c.
(late Assistant Chemical Laboratories, Royal School of Mines).

Quartz Outcrops between Auldbar and Glenelg.—On my way northwards from Auldbar to Glenelg estate, which was the next I was empowered to examine, I noticed several outcrops of quartz, notably at Nanguard, where in the river bed a true vein several feet in width, cuts across the lines of stratification of the gneiss in a N.W. and S.E. direction.

Glenelg Estate.—On Glenelg estate in the cattle-shed ravine there is a bed of quartz 2 ft. wide, and exposed for a distance of about 15 yards. It runs parallel with the lines of stratification of the fissile quartzitic gneiss, which forms a portion of the bed of the stream, taking a N.W. and S.E. direction, and dipping towards the N.E. at a very slight angle. A sample of this outcrop was submitted to assay in my laboratory and found destitute of even a trace of gold.

Oaklands Estate.—The geological features of the district in which this estate is situated have already been touched upon (Art. III., *Mining Journal*, p. 565) so there are only the quartz outcrops to notice.—1st, then in what is known as the Bungalow ravine there is a vein running through a small outcrop of syenitic rock. It has a width of from 1 ft. to 2 ft., and takes a W.S.W. and E.N.E. direction. —2nd. In the four-acre coffee field above the bridge that crosses the river at the lower end of the estate there is a quartz bed having a width of about 5 ft., and striking W.N.W. and E.S.E., and running parallel to the gneiss, the dip of which at this point is almost horizontal. It narrows out on the west side to a width of about 1 ft., where it is lost by a fault in the gneissic strata. A portion of this bed was blasted, as also of the vein alluded to above, and samples sent to Colachel to be forwarded to England for the purpose of assay, but through some unaccountable omission they were not included among the other samples sent from that port; their appearance, however, did not indicate the presence of gold.

Kildonan Estate.—On a portion of this estate, called the 50-acre clearing, there outcrops a bed of quartz about 6 ft. in width, running W.N.W. and E.S.E. along the side of a ridge which is parallel with the course of the stream that forms the north-western boundary of the estate. Besides this outcrop there is another three or four yards to the right of it, having a width of about 3 ft., and running in the same direction. Here the quartz appears as if it were simply an aggregation of boulders, the interstices between them being filled up with a clayey ferruginous material similar in appearance to the soil upon which the estate coffee is grown. These beds correspond in their general characteristics with those on Ballamore and Ballochbuie estates. (See Art. III., *Mining Journal*, p. 565, par. 1.)

Merchiston Estate.—On what is known as the 128-acre field of this estate there is an outcrop of quartz about 2 ft. wide, running N.W. and S E., the dip of which I could not very well establish, as the quartz is only exposed for a distance of 7 ft. or so. In a ravine which passes through the 128-acre field, about 300 yards to the S.W. of the one first noticed, there is another quartz bed about 1 ft. wide exposed for a distance of about 20 yards, dipping to the N.W. at an angle of about 15 degrees, and striking in a N.E. and S.W. direction.

Ballochbuie Estate.—Besides the quartz outcrop described at some length (see Art. III., *Mining Journal*, p. 565, par. 1) there are several others varying in width and in direction of dip and strike.—1st. In what is known as the bungalow field there has been cut by the water currents of the monsoon rains a small ravine. Its bed is composed of the soft gneissic rock which has been already spoken of as the source of the coffee soil of the country, and through this bed-rock and parallel with the direction of its strike, which is E.S.E. and W.N.W. there runs a quartz bed about 2 ft. wide, dipping to the south at an angle of about 75 degrees. On both sides the ravine where the quartz bed enters the coffee the soil and gneissic rock had been excavated to a depth of several feet, and large blocks of quartz blasted out. Similar peculiarities were noticed here as in the case of the large bed alluded to in Art. III. The quartz, instead of being homogeneous throughout, its mass was in isolated blocks, the interstices being filled with the light yellowish argillaceous matter which has elsewhere been designated laterite or soft clay-ironstone.—2nd. The bed at the side of the top road in the field, already described at some length in Art. III., *Mining Journal*, p. 565, may be accepted as a continuation of No. 1, as it strikes and dips in similar directions.—3rd. In what is known as Marion's Ravine there is an escarpment of gneissic rock, studded with the common variety of garnet, and having its lines of stratification very indistinct. In the face of this rock there is exposed a quartz mass, which at the base of the escarpment has a width of about 3 ft., and narrowing out to about 1 ft. as it is traced upwards along the face of the rock. This escarpment may be looked upon as a section of the country rock which has been cut through by aqueous agencies, for, facing the escarpment at a similar height, though covered by coffee soil, there is a corresponding rock mass. Admitting this quartz outcrop to be a transverse section of a quartz bed or vein, its strike would be E.S.E. and W.N.W., and this would place it in the same line of direction as the two beds already described, and which are only about a mile W.N.W. of this outcrop.—4th. About 20 yards farther down the same ravine there is a small vein of quartz running through a felspathic rock, and varying from 1 ft. to 3 ft. in width. It has a direction N.E. and S.W. —5th. In a ravine to the east of Marion's there is a quartz bed about 1 ft. wide striking in an east and west direction through gneissic rock. Samples taken from the several veins and beds mentioned above have been submitted to assay in my laboratory, and though they all showed appreciable quantities of gold, yet the results of the assays were not encouraging.

Strathmore Estate.—Though the leading rocks of the metamorphic series, with the exception of the quartz rock groups, are well represented in this estate, yet in the lower lying ground the quartzose variety of gneiss that constitutes the higher ridges both here and elsewhere in Travancore is less frequently observed, but one of the lighter varieties which in previous articles has been noticed as studded with the common variety of garnet is more prevalent. I did not come across what I should be justified in terming a satisfactory outcrop of quartz in vein form, nor did I observe any beds similar in character to those noticed on some of the other estates already alluded to in this and previous articles. On the left front of the chief superintendent's bungalow, and at a distance of about 500 yards from it there is a ridge of rock several hundred feet in height, composed chiefly of quartzose gneiss. At its summit this rock has a bleak aspect, and, unlike many of the ridges in its vicinity is almost destitute of vegetation. That portion of it which faces the left front of the bungalow forms a bold escarpment, which a few hundred yards further along is cut transversely to a great depth by a ravine, and at intervals of time during the past large masses of this rock have become detached by the action of aqueous and atmospheric agencies, and rolled in the form of boulders to varying distances down the less inclined ground at its base. The oldest of these boulder masses have themselves succumbed to the influences to which they owe their isolation, and are fast disintegrating and being broken up into smaller blocks. The dimensions of one I estimated at about from 25 ft. to 30 ft. in length, and about 15 ft. in width and depth. This rock mass I thoroughly examined with the obvious purpose of obtaining a clue to the composition of the rock from which it was broken off. It contains several veins of what might be termed honeycomb quartz, varying in width from 2 in. to 9 in., the interstices or cavities of which are filled with masses of magnetic pyrites. Owing to the oxidation of this substance the whole rock mass has a deep brownish-red colour. Several of these veins were blasted and submitted to assay, when appreciable quantities of gold were found.

To examine the next and last estate, a district of country, considerably over 30 miles in length, had to be traversed, the greater portion of which is still covered with unfelled jungle. As might be expected in passing over so many miles of primitive forest country a great variety of magnificent scenery was presented to view at every gap and opening, and many opportunities offered for observing the geology along the line of route. Here the more compact variety of gneissic rocks studded with garnets so prevalent in the southern districts were seen. There the more quartzose variety, sometimes forming gentle declivities, and at others standing forth in bold escarpments, weather beaten, yet apparently little worn, and giving one the impression that come what might they were determined to defy time as well as aqueous and atmospheric agencies to effect their degradation and dissolution.

Invernettie Estate.—Of all the estates which I was instructed to examine this one has by far the greatest outcrop of quartz, but as in the majority of other cases it is mostly of a bedded character.—1st. In the grass field to the west of the bungalow there is a ravine through which there runs partly along the lines of stratification of the gneiss an outcrop of quartz having a width of 3 ft. at its widest part, its strike is W.N.W. and E.S.E., and its dip almost vertical. About the centre of the ravine it would seem to have lost its bedded character, for it sends out a branch to the left about 1 ft. in width in the direction of E.N.E. and W.S.W. Looking towards the E.S.E. direction of this outcrop there is on its left another outcrop which continues for about two yards or so, and then loses itself in isolated nodules.—2nd. In the shade clearing about 100 yards beyond the lower coffee store there is an outcrop of milky white quartz, which first shows itself as a ridge several feet in width in the midst of jungle grass. Fifty yards or so beyond it is lost, but about 100 yards farther on where a ravine intersects its line of strike it is again exposed.

Here a number of trees had recently been felled by the superintendent of the estate, and lay scattered across the ravine so that its width could not be very easily determined, but 50 yards or so beyond this point it crops out again clear and beautifully white between the gneissoze beds, and having a width of about 20 ft. It strikes N.W. and S.E., or nearly so, and dips at a very high angle—almost vertical. I traced it for a considerable distance into Sircar (Government) property when my instructions reminded me that I could go no farther. I have, however, since been informed that Mr. Knight, of Arundel Estate, in accordance with directions which I gave him to follow its line of strike, again discovered it outcropping at a distance of some miles beyond the boundary of Invernettie Estate.

Near the top of the ravine, which runs from the above-mentioned coffee store to the bungalow, through what is known as the 25-acre field, there intersects the bed-rock a vein of quartz which runs in a zigzag W.N.W. and E.S.E. direction, and varying from 1 ft. to 3 ft. in width. There are several other outcrops of quartz on this estate, but neither in their width nor general characteristics are they important. In one, however, I discovered some auriferous pyrites.

Of all the estates which I examined in Travancore not one shows such large outcrops of quartz as Invernettie, and although most of them are of a bedded character, and consequently in the estimation of some authorities of much less value than if they were in the form of true veins or reefs, yet I respectfully submit that this does not constitute a sufficient argument against their being mined, as I shall show further on in these articles. The supply there, however, is apparently inexhaustible, and there is only one question to be decided, and that is as to whether they are sufficiently auriferous to warrant their being worked with a hope of success. I may state that up to the present date this question has not been decided.

Chemical and Metallurgical Laboratory, Lime-street, E.C.

DIAMOND FIELDS COLLIERY COMPANY.

SIR,—About March 19 there appeared in the London newspapers an advertisement of this company, and my name figures as one of the local committee. I wish to give, through the *Mining Journal*, publicity to the fact that my name appears without my knowledge or permission, and at the same time to inform the English subscribing public that the company, as advertised, is unworthy of support, and could not possibly in my opinion ever pay a dividend.

J. W. MATTHEWS, M.D.,
Late Member of the Cape Legislature for Kimberley.

Kimberley, April 20.

GOLD MINING IN VENEZUELA.

SIR,—After long and anxious expectation we are now approaching the time when handsome results will no doubt follow. Looking at the various accounts received, I glean that the Chile Mine will have 60 stamps in full work in June, when we may expect monthly returns of 3000 ozs., improving as the mining goes down. At the Potosi Mr. Fitzgerald has opened up the Peru lode to a great extent preparatory to starting crushing in May, when he will have an ample supply of quartz bearing 3 to 4 ozs. to the ton. June will certainly not pass over without convincing proof of the wealth of these two properties.

Callao Bis appears to be in a less forward state, but I believe that it will not belie the great expectations formed of it. With Mr. Albert Nicholson at the Chile, and Mr. Fitzgerald at Potosi, there is not the slightest doubt of satisfactory results being achieved during the current year, if not within the next three months. Speculation in these Venezuelan mines will, in my opinion, be one of the features of this summer.—*London, May* 15. J. R.

ST. JOHN DEL REY, AND ITS FUTURE.

SIR,—Having been absent from London since the time that my former remarks on the condition of the St. John del Rey Company's Mines, and "Investigator's" letter were criticised by "Vigilance," Feb. 24, no reply could be made. I now say that I am not giving the mine or the company any sly stab; I am openly commenting on such bosh as was published, Oct. 21 last, over the signature of "Investigator," and has had a mild repetition by "Vigilance," who thinks that no other gold mine in the world could present such a favourable report as the St. John del Rey offered, or was offered by its managers in the Journal of Feb. 17.—"Broad stopes, rich mineral," &c. Mr. Tendron told of the Magnificent Mine when the shares were selling at 250 or more. We know what dividends have been paid, panegyric was spoken, and we see how the pounds have been chipped off the price of the stock in its downward course.

"Investigator" gave us a long article on the King of Gold Mines, which, for astounding expectations, wild calculations, absence of any reliable information, was not eclipsed by Mr. John Lean's romance of the Brazilian Mines (Limited) which, while it suited his purpose, or the purpose of others, filled your columns week after week. In the letter of "Investigator" all facts were ignored, and after enormous profits had been calculated upon, the writer says, "I believe I have not exaggerated in any statement." I propose to keep this letter (of a well-known operator in the stock) before the public, to show what close relationship exists between an effort to "bull" stock by such fiction, and an effort to "bear" stock by a relation of facts which was called conspiracy at the time, and which now is proved was simple truth. The St. John del Rey Mine is deep, and as we all know is failing in the bottom; that is, the rich mineral has gradually narrowed in the bottom until it fails to keep up the average produce to a dividend point, and, in fact, it would seem from the reports that it barely pays expenses. We also know that the reserve fund has been considerably diminished—see December report. We know that so far Cuiaba is a drag; that this mine was not steadily improving when "Investigator" published his famous letter, and it has not since improved.

That the Morro Velho Mine is dangerous I need only to refer to a recent accident, costing the lives of four or five men, and to what is generally believed, generally known in Brazil. I should not have come out so soon, as I am not yet ready for "Investigator," had not this other letter appeared in the Journal of Feb. 24. I am a believer in the mineral wealth of Brazil, and especially in the gold mines of Minas Geraes. I know that private capital is being invested in its gold mines, and that the prospectors are more than satisfied with their prospects and the results already obtained; but I know of what I speak, and I do not want to buy shares in the St. John del Rey Company. I did not take the advice given by "Vigilance" to buy shares at once, as he thought they would not go down any lower.

City, May 14. INVESTIGATED.

BRAZIL, AND ITS MINING PROSPECTS.

SIR,—We are occasionally treated with articles in the Journal attacking the English companies working in this province, and foremost is the historical St. John del Rey Company. The wreckers are in this case favoured by the temporary suspension of dividends, and a low grade of produce consequent on some charges being made for better treatment of the stuff, and an admixture of killas with the ore that is passed through the stamps. I see that the "bears" have forced the price of the stock down to nearly par. This seems out of all keeping with the facts of large ore reserves and a fund of 50,000*l.*, or more, in the London banks.

Mr. Morris has just arrived in Rio, and the new machinery for treating the tailings, of which the company have vast quantities. Mr. Morris is said to come from the most successful establishment on the Pacific coast (California), where such tailings would be valued at, at least, 1,000,000*l.* sterling, and he proved by actual results taken from these tailings that from 100,000*l.* to 200,000*l.* net profit could be made out of them in a short space of time. Good Chinese labour is employed, and they say that the mine has been put in safe condition, the new hoisting machinery and cage facilitate work.

The principal topic in the mining district is the successful working of the Passagem mines and the developement of the gold mines at Raposos and Geriza by a private company. Mills are being erected to treat on a larger scale the ore, which gave very handsome returns in milling. I make these remarks as I see quotations for St. John del Rey stock so low as 130 in London, and hear of much opposition to all new mining enterprises in Brazil. TRAVELLER.

Minas Geraes, April 19.

THE FLAGSTAFF, AND DEFERRED HOPES.

SIR,—The letter of "Miner," in the *Mining Journal* of May 5, is of the greatest interest to the shareholders in the Emma, Vallejo, Eclipse, and Flagstaff Mines. The statements therein made are clear and easy to be understood, and most encouraging to all, but especially to the shareholders of the Flagstaff. In addition to what has been stated in the letter a report from the captain of the Flagstaff Mine describes the favourable appearances at the bottom of the shaft at the date of the latest operations, before shutting down the mine on March 13, which was necessitated by the want of funds. In that report he says—"Since my last the lode has improved every foot we sunk. The last shift we found a boulder of galena of about 50 lbs. weight; by this the company can see the condition of the mine, and that there is more prospect for ore now than there ever has been before, and no danger of striking old works. There is now only one man left there to guard the mine."

The mine having been shut down for want of funds to meet the wages and other outgoings the directors a month ago sent out a copy of the above and a circular letter to the shareholders, appealing to them to supply the necessary funds for re-opening the mine, and continuing the operations. Perhaps it will hardly be believed that this appeal has in very few instances been responded to, and then chiefly by small shareholders: The mine will have to be abandoned unless the requisite funds are immediately forthcoming. It seems to be thought that it is part of the duty of the directors not only to perform the legitimate duties of their office, but also to find capital to work the mine. The mine at the outset with every indication of success was, of course, a venture, but if it succeeds the shareholders will be compensated for their innumerable disappointments. The captain of the mine writes that the weather there since March 10 has been favourable for mining operations, and it is, therefore, important that no more time should be lost before commencing operations.—*May* 14. N. D.

ALMADA AND TIRITO.

SIR,—It must be now some months since there appeared in the *Mining Journal* one or two admirable letters, signed "Argus," relating to the improved condition of the Almada and Tirito Mines, compared with the hopeless state they had been in since they paid their last dividend, now some seven or eight years ago; but I have sought in vain for some recognition, either in the shape of an increased value in the property, or in contradiction to the really brilliant expectations, that the shareholders might look for. I myself have watched the progress of the concern, and I have no hesitation in saying that since the Almada and Tirito has been a public company it has never been in so good a condition as it is at the present moment.

There is a reason for all things, Mr. Editor, and, perhaps, I cannot do better than give you the impression made upon a couple of friends whom I was desirous should become shareholders. They stated to me that they believed the statements made by "Argus" were perfectly correct, but the double expense of management in Mexico (which was very good) and that of London was more than the concern ought to bear, and that until some means were taken to reduce it they should not connect themselves with the enterprise. They mentioned that the secretary was quite capable of carrying on the correspondence without the aid of directors, who continued to receive their salaries, while the company were borrowing money on bonds paying 10 per cent. interest, so that the management in London was continually being paid for out of capital.

I certainly myself think that, under the circumstances, three consulting directors would be sufficient to confer with the secretary or manager, and as "Argus" seems to have given himself so much trouble on behalf of his brother shareholders, and that most probably he is a considerable shareholder, why should he not be one of the three, evidently knowing well what he is about? J. Y. S.

London, May 17.

COAL MINING—NEW SOUTH WALES.

SIR,—Coal mining here has been kept principally in the hands of local companies, who beginning with small capitals (mostly) have crept into their present splendid success by devoting their earlier profits to finding funds for properly opening and, at last, fully developing their properties instead of pocketing handsome dividends directly they were fairly at work, as would have been the case had they begun with 50,000*l.* or 60,000*l.* working capital at first.

Lately, however, English capital has been engaged in developing one of our southern sea-coast mines, and from all I have heard, and what little I also know of the mine and its position, I should say it has an excellent future before it, especially as where good management means good profit, it has the large personal interest and long colonial experience of Mr. Ebenezer Vickery, J.P. (of Sydney) invested in it also, his name here being a "tower of strength" to any commercial venture it is associated with.

The following extract from the Sydney Mining Herald refers to the first real beginning of work at the new mine, and it may, therefore, interest some of your readers, who may happen to be shareholders, to know that their venture is now in print for the first time:—"The Mount Kembla Mining Company have sent down to the jetty at Port Kembla the first shipment of coal. About 200 tons are ready for shipment to Sydney. The steamer is expected to-morrow. The jetty, constructed under the supervision of Mr. Kingmore, is a most substantial piece of work. The appliances for shipping appear very complete, and the largest vessels can safely approach the jetty, there being deep water in every direction, with plenty of space for anchorage. Heavy mooring buoys are placed in position, and everything appears to be done to accommodate a large trade. The coal appears of excellent character. The shipping place, known as Port Kembla, situated on Five Island Point, is most commodious, and offers every facility for steamers, and, when the tug is furnished, for the largest sailing vessels. The jetty is sheltered from all quarters, except the north east, the islands forming an almost complete breakwater. Sailing vessels can approach with almost any wind. The mine itself is connected with the shipping port, about seven miles

distant, by a substantial railway. About 30 miners are at work. The numbers will be increased as soon as more ground is opened."

Sydney, April. R. D. A.

HORNACHOS MINING COMPANY, AND ITS MANAGEMENT.

SIR,—Permit me to say, with reference to the circular issued by this company on May 8, that the circular of April 24 mentioned therein is issued by a board of directors, four out of six of whom issued a prospectus in 1881, asking for additional capital, in which they say—"The property is in full working order, provided with substantial buildings and modern machinery of the best description. The mines have been thoroughly proved. There are large reserves of ore already accumulated; it is anticipated regular monthly shipments will be made from September, and enable the company to commence paying dividends at an early date."

At a later date the directors pestered the shareholders with repeated circulars to raise yet still more capital explicity to pay off the debentures. This amount too was put into their hands, but it now appears the debentures are not paid off. Yet, now, at the same time they publish a report most damaging to the management of the company, and after receiving more than 1700*l.* in fees for superintending such acknowledged mismanagement, the same board of directors, with only two new names on it, have the obtuseness and assurance to command more capital, accompanied with an implied threat that if not forthcoming they will go into liquidation without calling the shareholders together, and offering them the option of selecting from among themselves men of business and experience to replace men who, from their own confession, have been most inefficient and remiss directors.

In August 1881 it appears that 7564 10*l.* shares were held in London and 835 in Birmingham; what can these shareholders be thinking about that they do not insist upon a change of management? Are they content to throw up the affair as a bad job without any effort to save their money? The Quebrada shareholders set them a different example at three different times intervening and insisting on fresh management, and now that company is paying dividends regularly, notwithstanding the accumulated encumbrances caused by blundering and by unscrupulous schemers. Surely it is time for the Hornachos shareholders to do the same, and to wrest their property from the possibility of any sinister scheme which may be brewing.—*Barnstaple, May* 10. W. SYMONS.

RETIREMENT OF MR. ROBERT HUNT, F.R.S.

SIR,—Although the important and interesting business hitherto transacted through the Mining Record Office will still be efficiently carried on in its new channel, it is with feelings akin to regret that miners read in the *Mining Journal* of its abolishment, and the retirement of Mr. Robert Hunt from a position in connection with which he will ever be remembered with the greatest possible respect, especially by readers of the Journal, to whom his name has so long been familiar, and from the deep interest they have always taken in his valuable researches. The fitting tribute paid to Mr. Hunt's honourable and useful career in the Journal of May 5, with the intimation that any contributions from him in future will be as acceptable as ever, are, I may safely say, simply a reiteration of all its readers' sentiments towards that gentleman, who is well worthy of another testimonial or an address of appreciation for the services he has so efficiently and significantly rendered to his country.

The meeting at the Mining Record Office, Jermyn-street, reported in the *Mining Journal* of Aug. 11, 1860, will show how generally Mr. Hunt's labours have been appreciated. The subjoined extract from the report in question will be worth reprinting. It is stated that:—

> A meeting of the subscribers to the Hunt Testimonial Fund was convened for Saturday, at the Mining Record Office, Geological Museum, Jermyn-street, when a handsome silver tea and coffee service, of the value of 200 guineas, was presented to Mr. Robert Hunt, F.R.S., Keeper of the Mining Records, to testify the esteem felt for him by the subscribers, who are gentlemen deeply interested in the mineral industries of the kingdom. It consists of an elegant silver tea kettle, lamp, and stand, richly engraved, tea and coffee pots to match, cream ewer, sugar basin, and hot milk jug *en suite*, the whole very elaborately engraved and ornamented, and bearing the cypher of the recipient. A very handsome silver oval salver, weighing 200 ozs., accompanied the service, and upon it was very beautifully engraved the following inscription:—
>
> "Presented by the subscribers, who are interested in the Mineral Industries of this Empire, together with a tea service and a purse of sovereigns, to Robert Hunt, Esq., F.R.S., F.G.S., F.S.S., &c., Keeper of Mining Records,
>
> To record their sense of the energy and ability which he has shown in originating and carrying out the publication of the Mineral Statistics of the United Kingdom, and their admiration of his public character and private worth.
>
> *Nil sine magno vita labore dedit mortalibus.*
>
> July, 1860."
>
> A purse of 200 guineas also accompanied the Testimonial, which was in style and workmanship fully worthy of the excellent recipient, and in the best style of the manufacturers, Messrs. Hunt and Roskell, of New Bond-street.

I appeal to some abler pen than mine, and I cannot think my appeal will be in vain, to take up this matter in earnest, and let us, one and all, amalgamate in showing that England, as ever, is ready and willing to appreciate and recognise the sterling value of those of her sons who have so faithfully devoted their time and talent in her services as Mr. Robert Hunt has done. In the unlikely event of his retirement severing his personal connection with the Journal, I can only say such a step would be greatly regretted. I feel confident that he has the heartiest wishes of all its readers for his future welfare.—*Perranporth, May* 16. WILLIAM NINESS.

MINING MACHINERY FOR INACCESSIBLE COUNTRIES.

SIR,—In answer to "Gold Miner," and while thanking him for his testimony of the value of my stone-breakers, I beg to assure him and your readers generally that not only are my pulverisers capable of reducing auriferous quartz to a sufficiently fine powder to admit of the whole of the gold being extracted without any further crushing, but they are actually in use for that purpose in some of the best paying mines in the world. I have several repeat orders in hand at the present time for the same machine. This new patent pulveriser will reduce to any degree of fineness required, and I make it in pieces of light weights for transit on mules' backs in mountainous regions, and the large machine will take in pieces of quartz, &c., 20 in. wide, by 5 in. thick, and of any length. H. R. MARSDEN.

Leeds, May 15.

ROCK-DRILLS—WITHDRAWAL OF CHALLENGE.

SIR,—Most practical mining engineers in Cornwall were amused at the challenge of Messrs. MacKean and Co. to run their rock-drill against that of any other maker, binding themselves to the forfeit of 100*l.* unless they bored twice as much as any other drill in a given time. And by the withdrawal of the challenge in last week's Journal they more fully establish their ability to cause amusement, as well as to appreciate the "actual laughing outright" of other people. It is doubtless a great joke to speak of the "hard heads of Cornishmen being used as battering-rams to bump down the rock," and while we can conceive even this being resorted to if there were no better machines than those of Messrs. MacKean and Co., yet we think there are other machines from which better speed can be obtained.

We think Messrs. MacKean and Co. need not reflect long whether they should send their machines to the "Land's End or Patagonia." In Patagonia their machines might astonish the natives, but in Cornwall they are regarded as an obsolete article, which no doubt did good service in their day and generation. We note Messrs. MacKean's statement, that for 16 years they have been trying to introduce boring machinery into that "tag-end of creation, Great Britain," without satisfactory results, and we think if they have no machinery but their own their chances will year by year be growing less, for it reminds us of the cow chasing the hare—the longer it ran the further it was behind.

We object, however, to Messrs. MacKean and Co. withdrawing from a challenge under cover of their brilliant jokes, for we will in a business way run the "Cornish Rock-drill" against those of MacKean either in a tunnel, where practical utility could be best judged, or in granite blocks as suggested, or in any other way, provided that the contest be under the supervision of competent mining engineers, and the tests to embrace durability of machine, speed of boring, and quantity of compressed air consumed, and this on equal terms, as we feel assured that in all the above particulars the "Cornish" drill would be found superior to the MacKean, instead of the latter being 100 per cent. more effective, as per Messrs. MacKean's challenge. We would repeat the suggestion that the trial could be held with advantage in the Kit Hill tunnel, not because we have furnished the machinery, as Messrs. MacKean supposed, for we have not; but simply because of the facility of access which it offers rendering it more suitable than any other place in the West of England.—*Camborne, May* 17. HOLMAN BROS.

P.S.—A portion of our letter of April 28 should read: "Allowing two-fifths of the time to be taken up in fixing and changes of drills, it would mean no less than 4680 in. of holes per day.

ROCK-BORING MACHINERY.

SIR,—Surely Mr. Henry Penrose is entirely ignorant of the machines in Cornwall. Let me, therefore, inform him that 10 machines or more can be found, all of which are by different makers. Further, I can enlighten him that they will all bore effectively, the knowledge of which he seems perfectly innocent. They are the Darlington, the Barrow, MacKean's, Eclipse, Ingersoll, Schram's, Kainotomon, Warsop and Hill's, McCulloch and Holman's, and Stevens, the most recent. There have also been used at different times the Burleigh, Beaumont, and before either, Dœrings at Tincroft and Dolcoath. Four of the above machines can be seen within a mile of Lanner. So much for Mr. Penrose's knowledge of what he writes about. Mr. Penrose says—"Inventors forget that when they come to Cornwall they have to deal with men who know their business as miners, and therefore cannot be gulled by persuasive eloquence like London boards of directors," &c. Ignorance is bliss—the happy state in which Mr. Penrose reposes.

Every machine introduced into the county until effectively successful, and until the so-called practical Cornish miner's prejudice and ignorance was dispelled, has been from the outside, instance Dœring's, Beaumont's, one from Whitehaven, and Darlington's. These were introduced and worked by men who served no years in Cornish mining, and yet were the most successful. Let Mr. Penrose spend a day in investigating the causes most conducive to success in driving with boring machines. He will find wherever speed has been attained it has been by young men and boys—boys where the prejudice did not exist. To obtain speed depends almost entirely on the men employed. With some any machine does moderate work, with others no machine will do. Few or any do the work that can be done, and few have done it.

The essentials of a boring machine are strength and force of blow in excess of the hardness of the rock or capel, the force or blow to be obtained by the least loss of air; simplicity of construction and absence of outside gear, so apt to be broken by rough handling and knocking about underground. Let Mr. Penrose make enquiries and he may find out where the greatest amount of levels have been driven, the cost per fathom, the cost in machines and repairs, then he may enlighten his fellow Cornishmen and all interested in mining. As Mr. Penrose claims such superiority for practical Cornishmen let him inform us how it is shaft sinking by boring machines in Cornwall has never succeeded as has been done in America, Germany, Belgium, and even in the Isle of Man. Is it due to superior practical knowledge of the Cornish miner?

The Ferroux drill may do well enough for a railway tunnel where there is 12 ft. to 30 ft. to angle the machine, but it is no good for a level 5 ft. 6 in. by 7 ft. Offer 50*l.* premium to the best nine or twelve men who drive 50 fathoms in the shortest time, and something practical will come out of the correspondence, but all the challenges in the world will prove nothing and end in nothing. Years have passed since this question first occupied your columns. What is the result? Nil.—*Lanner, May* 15. H.

ROCK-DRILLS, ANCIENT AND MODERN.

SIR,—I notice in the *Mining Journal* of April 28 that Messrs. MacKean and Co. doubt the statement I have made—that it is nothing for a modern machine to stay at its work for two or three months without any breakage. I can assure them that such is the case, and in more instances than one. I have no doubt that this is strange news to them, and what they have not been accustomed to in their machine, as I am fully aware that it is nothing unusual for some part of their machine breaking down in boring a round of holes in the face of a heading. I am sorry to see that Messrs. MacKean and Co. do not fall in with the views of Messrs. Holman Bros. and Mr. Schram—to put down the 100*l.* and have the trial in a tunnel heading, as the holes would then be bored mostly in a horizontal position, such as is done in practical mining. With regard to the excuses they make, such as the different systems of carriages, mountings, rails, and expenses, &c., I believe that could easily be got over, as from what I understood from their challenge it was not a question of system, but merely the boring power of the machine. That being the case each machine could be mounted on an ordinary stretcher bar, and the expenses I am sure would be much less, as the power would be provided, and, perhaps, the ground bored would be paid or the labour connected with it.

If it is a question of system I should like to be in at that along with my patent carriage, and the Cornish rock-drill mounted upon it. I believe the mining public would then see ground driven with both speed and economy—or, in other words, ground driven at three times the speed of hand-labour, and at no more cost, if anything less. But I trust that, one way or the other, Messrs. MacKean and Co. will bring this trial to a close, instead of talking so much about it. It seems so far that they are not serious in their intention, but merely trying to hoax the mining public.

I notice that several correspondents endorse Mr. Vivian's suggestion with regard to the proposed trial. Now, his suggestions are exactly what has been carried out in the last two rock-drill competitions—a committee was formed to judge the trials, and this committee consisted of some of the most capable and well-known mining and engineering men of the day, and the highest awards given by them in both trials to the Cornish rock-drill was published in the *Mining Journal*. That being the case it is only fair that the Cornish rock-drill should be recognised until the trial comes off (and no doubt afterwards) as the best rock-drill in the market. I would beg to inform Mr. Henry Penrose that the adoption of good rock-drills in Cornwall has been more than he seems to be aware of, as the last two years the Cornish drill has been adopted in above 10 of the principal mines in the county, and I may say that each machine has gone to the mines solely upon its own merits. J. MCCULLOCH.

Huelva, May 12.

LEVANT MINE, AND ITS MANAGEMENT.

SIR,—The singular position that this important mine occupies is without a parallel, although it has sold under the present company mineral exceeding in value 140,000*l.*, and has called up nearly 28,000*l.* As yet it has been without an auditor, who should be in a position (and, what is more, would not be disinclined) to give full particulars how the moneys of the adventurers are being dissipated in account-house expenses, sundries, &c. To elucidate this the secretary should be ordered to draw up a balance-sheet containing a list of all bills exceeding 1*s.* and submit it to his supervision, the same to be printed together with any notes or remarks that he (the auditor) might think proper to append, and a copy sent to every shareholder prior to holding the account. Surely with such an example as the late catastrophe at Dolcoath, which has a committee, but not of vigilance, it seems imperative that all mines should have their accounts thus audited by some efficient person, unconnected with the mine as shareholder or merchant, and not related to any official drawing a salary. The more effectually to carry out this proposition on behalf of the Levant adventures, it would be advisable to remove the mine account meetings to Penzance, so that our largest shareholders, smelters, &c., who reside there and in the neghbourhood might be enabled to attend and enter fully into the details of working the mine, and thus show a deeper interest than they have hitherto done, for the sake of our more distant adventurers. At present every obstacle is thrown in the way of an individual like myself learning the details of the expenditure. The general assembly of shareholders, which is summoned every 16 weeks, becomes resolved into a committee meeting, and shortly before dinner is placed on the table (to partake of which and its adjuncts seems the sole reason of the presence of several) the adventurers are invited to enter for the purpose of passing the accounts, which are hurriedly read out in a lump: so much money expended, so much received for mineral sold. Occasionally when there is some object in view a large quantity is credited unsold, one-half of which is not on the surface. This measure is generally considered so extremely equivocal that the different members of the committee individually protest against it, but collectively recommend it on the ground of expediency.

The resignation of Capt. H. Trezise having been accepted, the committee, without the authority or consent of the shareholders (as they have acted in many other cases) selected two ordinary miners to fill the place of one agent. Being divided in their choice, to compromise the difficulty they installed both, consequently the shareholders are called upon to pay for their fancies. I should state that Capt. James Newton is a very intelligent man, and is doubtless very cheap at his salary of 6*l.* 6*s.* a month. The same amount is allotted to the two sub-agents, which sum put together, and amounting to 12*l.* 12*s.* a month, would be a fair one for one suitable managing agent, whom I think we might procure if the committee were remodelled, or, better still, dissolved.—*St. Just, May* 16. RICHD. B. SEARLE.

THE COST-BOOK SYSTEM—DOLCOATH FRAUDS, AND "BOGUS" SHARES.

SIR,—With reference to the recent misdoings at Dolcoath it has been remarked that—"Under the usual practice of a Cost-book mine it would be difficult to discover any wrong doing as alleged except in the case of a mine paying dividends." It would indeed be difficult if not impossible. From the same writer's opinion it appears that these frauds were brought to light by the action of a shareholder, who refused to take a cheque from the accused's private cheque-book in payment for his dividend. This undecked a discrepancy of 100*l.*, on which immediately followed a confession by Mr. John Mayne, the delinquent. Before the passing of the Limited Liability Acts "bogus" shares often distressed the mining public, and the ruin of well to do and innocent men, by being compelled to pay debts which they had not contracted, and were not even cognizant of distressed private parties, and brought to beggary whole families through the operation of the Cost-book System.

To remedy these and kindred evils (more felt in Cornish mining than in any other enterprise) Limited Liability Acts were passed, with a reservation of the right to work mines in Devon and Cornwall under the ancient Stannary Laws. The Dolcoath adventurers, as I am informed, applied to the proprietor of the soil to be permitted to convert their company into a Limited Liability company, but were refused the privilege, although the proprietor of those mines is said to have sold a large number of shares, owing to possible responsibility for costs beyond his share of debts in Dolcoath; if this be so clearly the proprietor condemned the Cost-book principle, whilst he compelled the shareholders in this and other mines to work under that system which compulsion is evidenced by the following clause inserted in leases granted by him:—"And also that they the said grantees, the executors, administrators, and assigns, will from time to time, and at all times during the said term, carry on the said mine and works, or cause the same to be carried on on the Cost-book System, and in strict conformity with the rules and regulations comprised in the schedule hereunder written, and will keep or cause to be kept hung up in some conspicuous place in the dry, and in the smiths' shop upon the said mine or works true copies of the said rules and regulations." If a Cost-book System landlord were interrogated respecting these restrictions his reply would doubtless be the same as that of the old Duke of Newcastle, when spoken to with respecting his sale of private boroughs before the Reform Act, 1832—"surely a man may do as he will with his own."

The writer of this would be the last to dispute the right of individuals in the soil—carry that doctrine to its extent and no man has a right to his freehold cottage nor to a piece of ground in which to bury his dead out of his sight, but as General Grant well puts it property and privilege have their corresponding responsibilities, and surely the following are heavy responsibilities assumed by those who refuse to demise their lands to be worked according to the statute law:—

A very large landed proprietor in the Dolcoath, Tolgus, Basset, and other districts owns many mines which capitalists are and for years have been ready to work. This Cost-book System proprietor says—No; you shall work these mines on the Cost-book System only, and under the covenant above extracted—in other words, not only on the Cost-book System, but on that system, modified to my will. What is the result? The Cost-book System proprietor limits the production of tin, copper, and lead in the country; he cripples the trade of Camborne, Pool, Redruth, and other places. He expatriates a number of honest, industrious miners; he separates men from their wives and children; he causes distress to widows by sending their sons, their only supports, out of the country, and by his acts leaves a large number of children in poverty.

Do these Cost-book System landlords reflect that no metal is increasing in price? That they are rousing against them all working men and shopkeepers, and that by-and-bye if they are not careful their "country seats" will be made unpleasant. If I am right, the Cost-book System landlords are responsible for the bogus shares and the greater part of the distress in the Camborne and other districts.

Now I turn to a, to me, more congenial and agreeable phase in this Cost-book System. The first man by position in England has shown himself to understand his responsibilities—the Lord Warden of the Stannaries (the Duke of Cornwall), the man who of all men, if his own interests had swayed him, must have sided with the Cost-book System proprietors, has by his acts declared that the true interests of England are paramount to all minor consideration, and he—the Prince of Wales—grants without hesitation under the Limited Liability Act, although he is the Lord Warden of the Stannaries of Cornwall. J. E. S.

KIT HILL.

SIR,—Kit Hill is the apex or culminating point of the Hingston Down granite upheaval, 1067 ft. above sea level. This upheaval is very curious and interesting, and almost appears like a connecting link between the Caradon range and the Dartmoor hills. From the summit of Kit Hill a splendid panoramic outlook is to be had on a clear day, spreading in every direction, embracing the Dartmoor hills on the south and south-east, the Caradon range on the west and north-west, while to the south and south-west appears the estuary of the Tamar, spanned by the magnificent Saltash bridges, the sound with its ships, the breakwater, and beyond the open Atlantic Ocean. Northward is to be seen the highly cultivated parishes of Stoke Climsland, South Sydenham, Milton Abbot, and Lamerton, with Tavistock adjoining, looking in the distance like one splendid productive garden. The old hill itself would seem to be teeming with wealth, hence granite works, brick works, terra cotta works, and mines meet the eye in various directions. Tin, silver, lead, copper, and arsenical pyrites are being sought after and found in more or less quantities all over and around the foot of this, for our small country, huge geological disturbance. Just at the north-east foot of the hill, and embracing in the sett a part of the granitic upheaval cropping up to the surface is that monarch of eastern mines, the Devon Great Consols, which has given up its ore, chiefly copper, to the value of many millions. Close at hand is Bedford United, which under the old name of Wheal Marquis paid a very large sum in dividends to the shareholders. All the ores from these mines have been taken from or found in the killas or clay-slate. Close to Bedford United across the river is Old Gunnislake, which is said in its palmy days to have poured almost fabulous wealth into the purses of its owners. The ore, of a very rich quality, was found principally in the granite. Next we come to Gunnislake (Clitters), also in granite; this mine has been somewhat disappointing, but it should have a brighter future.

Just across the Tamar, and close to Devon Great Consols, is a group of mines working on a small scale, but which from their geological position are more than likely to excite considerable interest in the future. These are West Devon Consols, New Devon Consols, and Wheal Benny. Through these setts run several fine lodes, intersected

by several cross-courses, and skirting the whole, and underlying towards the group is one of the finest decomposed elvan dykes to be seen in any country. A very fine and highly productive lode has been opened and wrought upon in Wheal Benny, and towards this lode an adit is being driven in New Devon Consols into the hill by the side of a cross-course. This adit is more than 100 fms. long, and when the lode is intersected will give from the rapid rise of the hill between 40 and 50 fms. of backs. Nearly all the productive lodes of the Great Devon must necessarily pass this group of mines. Moreover, the Wheal Benny lode is highly productive for tin and arsenic. The country or stratification being a beautiful soft killas is all that can be desired for the production of all kinds of mineral. Can anyone give a legitimate reason why this should not prove a second Dolcoath district?—*Calstock, May* 15. H. R.

MINING IN CARDIGANSHIRE.

SIR,—For sometime past we have heard little respecting the mining interests of Cardiganshire. I can only judge from this that, through the ruling depression in the lead trade, many of your correspondents have lost their wonted energy, forgetting there are undoubtedly properties worthy of their comment, and probably not looking to the fact that other metals have been comparatively as low, and still from the depths of despondency have given wealth to those who have faith. I am not a prophet, but still have an affection for the health-giving hills of Cambria, and my opinion is that there is still a bright future for lead mining—irrespective of gloomy thoughts, no doubt engendered by the continued fall of lead, which, in my opinion, cannot last much longer.

I should really like to see a little, at least, of the old spirit animating the mines of Cardiganshire. If a mine be a good one say it, and never fear though investors admire that which glitters and only glitters for their loss—be assured that ere long the heart of the lead miner will cease repining.—*Mincing-lane, May* 14. M. C.

THE CALLINGTON DISTRICT.

SIR,—I have seen some splendid ore broken at the bottom level in the Langford Mine; when they get a little further advanced, so as to be under the shoots of copper and silver ore found by the former workers, very great improvement may be reasonably expected. The company have the good wishes of the whole district, and their machinery is ample for going a great depth, and is excellent in quality, second to none in the district. The strata is everything that can be desired for the production of ore; we hope ere long to see them in the market with their ores. I am pleased to hear the lode in Trebartha Lemarne is as good or better than ever. There is no second opinion but what this is the richest young tin mine in the county. They are now erecting their stamping machinery; when completed they will soon have tin in the market, and as we have such an abundant supply of water for all requirements it will be a very inexpensive mine to work. Wheal Lusky is a promising young mine; a lode from 7 to 8 ft. wide, and spotted with yellow and grey copper ore, must certainly be going to lead to something good. J. BUCKINGHAM.

Callington, May 16.

GWENNAP MINING DISTRICT.

SIR,—It has long been a matter of surprise that the granite hill forming the western and south-western boundary of this exceedingly rich mineral district has remained undeveloped. Immediately adjoining the granite range the largest, richest, and deepest deposits of copper ore have been found. The Consols Mine was developed below the 300 fm. level, Clifford to about a similar depth, Tresavean to the south 328 fathoms, as well as many other mines. The only comparatively shallow and untried ground is to the west of St. Day to Redruth boundary, and to the north and west of the village of Lanner. This is now being proved by the sinking of North Penstruthal Highburrow shaft, now down nearly 150 fathoms. The present company resolved to sink the shaft 20 fms., hoping that a more congenial mineral-bearing stratum would be met with. The expectations of the shareholders seem about being realised; the last few feet sinking has shown a great change, and very similar to the flat-rod shaft of South Penstruthal, where in the last-mentioned mine the shaft is going down in beautiful branches of copper, dropping down and falling into and forming a part of the lode. The desire of all who know this district has been to see what the unusually rich lode at a shallow depth would make between the 150 and the 200 fm. level. In North Penstruthal, at the 150, the junction of two large lodes will be met with, which are expected to yield much tin, and remunerate the shareholders.—*City, May* 10. Y. Z. A.

THE LISBURNE MINING DISTRICT.

SIR,—The Lisburne mining district is known as containing some of the most profitable silver-lead mines in Cardiganshire; and taking into consideration the area they occupy, and the amount of capital invested, there are not many mining districts anywhere which can show more favourable results than this. On referring to the ordnance map, sheet 59, it will be seen that within a space of about 2½ miles, on a section line drawn nearly north and south, are about a dozen champion lodes, including those of Frongoch, Wymess, Red Rock, Logan Las, Glogfach, and Glogfawr, formerly forming the group of mines known as the Lisburne, but now subdivided, and held by different proprietors. A little further south on the same line we have the Esgair-mwyn and Esgair-ddu Mines, celebrated for having made large returns from very shallow workings long before the Lisburne Mines started on their successful career. It is a strange fact that little has been done to develope these lodes westward of the boundaries of the various setts referred to. This is the more remarkable, as several of the lodes can be traced in many places on surface, following, as it were, in an almost undeviating course of east and west, and in the same Lower Silurian formation as that in which they have been proved prolific of lead and blende ores at the Lisburne Mines.

The almost only exception to this unaccountable neglect of a fine mining field is Grogwinion, which stands immediately westward on the northern flank of the section referred to. This mine, after leading a sort of fitful life for generations has, at last, under the energetic and spirited management of its present proprietor, come into the front rank of Cardiganshire mining, and will no doubt long continue to hold its place, seeing that it is as yet only a few fathoms under surface water-line. Immediately westward, on the southern flank of the same section-line, we have the West Lisburne, which, from its position and the spurty way in which it has been dealt with for generations past, may be very aptly styled Grogwinion's twin-brother. It remains to be seen whether the present proprietors of West Lisburne will develope the splendid property they undoubtedly possess. Here they have one masterly lode, about 20 ft. in width, producing some of the best through and through orestuff to be seen at any mine in the county; and there are apparently thousands of fathoms of such ore ground already developed, as far as sinking and driving is concerned, requiring only stoping down and hauling to surface for the crusher, which is already on the spot, needing only fixing and to be set agoing. Here they have another lode standing undeveloped, only a few fathoms north of the workings, and from which lode anyone who visits the place can pick up, in a costean pit on surface, very fine specimens of lead ore coated with carbonate of lime. The company are doing wisely in pushing out a deep cross-cut to get at this lode, and the result may be watched with great interest. But, independent of this, the south, or main lode, contains in itself a large deposit of undeveloped wealth, the main shaft as yet being only 40 fms. deep, a point which could within a few feet be drained by a deep adit brought up all the way on the course of the lode.

The question naturally arises how it is that such fine property has been so neglected. Well, in the first place, it is not the only thing neglected in this part of Wales. I think that the causes which have contributed to retard the progress of West Lisburne in the past are patent to anyone who cares to study the matter on the spot. In the first place, water-power during a few months in the year is scarce here, and the old proprietors did not collect all the water available, and what they collected was not disposed of to the best advantage. In fact, they wasted more than one-half of it. In the second place, coal before the making of the railway which now runs through the sett was very expensive, and a badly-constructed steam-engine, such as the old one was, made the waste of fuel in proportion to the power produced something frightful. Notwithstanding all these drawbacks, the old proprietors did a vast deal of pioneering work, all of which has been left for the present company to avail themselves of if they will only just put their shoulder to the wheel for one vigorous push to get at it. It must be admitted that the present company have done much to rectify the waste of water-power to which I referred by collecting several strong springs allowed before to run waste, and by erecting a splendid 45-ft. water-wheel and a long line of most substantial pumping-rods and connections, all of which work as smoothly as a watch. It only remains for them to erect a pumping station at a moderate cost to bring sufficient water back for dressing purposes, and they can at once commence making returns and increase them steadily.

Nature and the old proprietors have done much for the present company, and if they will only just finish the work they have commenced they can establish one of the finest mines in the Lisburne group.—*Aberystwith, May* 16. TEIFION.

GOLD MINING, AND ITS MANAGEMENT—No. IV.

By THOMAS CORNISH, M.E. (late of Australia).

Author of "Gold Mining: its Results and its Requirements." "Our Gold Supply: its effects on Finance, Trade, Commerce, and Industries, &c."

As instances of the difficulties of defining the rights of companies under the Frontage System, I may mention that on the Golden Point lead, beyond the private property of the township, were the Extension Company, the New Constitution Company, the Cosmopolitan Company, the Kohinoor Company, and the Band of Hope Company, the parallel lines representing the supposed area under which the lead may traverse, swept over an extensive stretch of country, and to suit their purpose they could swing their imaginary boundary lines any point from north to south. It took many years to trace the course of the lead through the first four companies, and when proved by the Kohinoor Company it was found that instead of Gold Point going westerly it had taken a sudden bend and gone due south, thus leaving the Band of Hope Company's shaft nearly a mile away from the gutter, which after 10 or 12 years' labour and great expense, sinking a deep shaft, was ultimately proved to be on another lead altogether. The great Extended Company, registered for claims on the Redan lead, bottomed this shaft in the Golden Point, which by right of registration belonged to the Band of Hope Company. The Extended Company being in possession stuck to their rich ground for years, and to all the gold they got, while the Band of Hope brought all the powers of law to bear to try and displace them. The attempt was fruitless until the connection with the Kohinoor Company was ultimately proved; it was not likely they would quietly relinquish a claim when their shares were worth 3000*l.* each for the eightieth share, and with plenty of money to fight with. The lawyers were not likely to give up a case which had been so profitable to the profession. The dispute was ultimately settled by amalgamation. Then lower down the plateau other companies became similarly involved in dispute, until the whole place was entangled in a network of lawsuits, with no possibility of the law courts being able to decide the rights of parties, because the boundaries of claims, and the length and course of the leads, could not possibly be determined until they were nearly worked out—in fact, it was impossible to define a boundary, or the rights of any particular company, until the gutters or leads were worked out. The whole system proved to be utterly impracticable, "a delusion and a snare; it lulled people into a fancied security of titles, which dearly-bought experience proved to be utterly delusive." It was not merely the enormous waste of money in law to prove an imaginary title into an actual fact, but it was the waste of time and labour and general insecurity of tenure that created such an uncertainty of results and depreciation of the value of properties. For several years a large tract of country on the Ballarat and Sebastopol plateau, occupied by a number of mining companies, were involved in doubt and uncertainty about title, which ultimately ended in law, until the parties concerned were wearied and disgusted; when common sense had to be brought to bear, instead of the venditta-like and malignant feeling that law had engendered, to effect compromises and amalgamations as a final settlement of disputes.

Foreseeing what difficulties were sure to, and did after, arise from the effects of the iniquitous system, I exposed the whole absurdities of the measure, and endeavoured to effect the only reform capable of remedying the evil by advocating its total abolition. The whole system was so devoid of common sense that it could not be amended, and the tinkering attempts to do so were miserable failures. In 1863 I endeavoured to cut the gordian knot of the difficult entanglement of law by effecting an amalgamation of the several companies then interested on a common basis of valuation of interest at the then market value, and instituting arbitration for law. The arguments I used were admitted to be correct, and approved of by the judges of the Court as the only solution of the difficulties; but prejudice and self-interest in prolonging the suits at law, with overweening vanity and arbitrary actions of the then manager and directors of the Band of Hope Company, who were determined, if possible, to sweep off all other companies from the radius of their magic lines, prevented the amalgamation being entered into, and thus putting an end to litigations. Had the views I proposed been adopted it would not only have settled all disputes at law and equity then involved, but would have increased the value of the stock and shares by over 1,000,000*l.* sterling, and would have inaugurated an improved system of mining and its management at an earlier date. In lieu of frontage titles I advocated that all claims in any place should be a defined block or area, and not a series of imaginary lines sweeping all points of the compass at will. As regards the area of ground in dispute the Legislature could have been induced to pass an Act of Parliament for a special lease to be granted covering all the Crown lands between (say) a line from Sturt-street (a centre of Ballarat), south to the Bonshaw Company (a freehold property), and from the Sparrower River or the Sebastopol road westward to the private or sold lands—an area of about 2½ miles by 1 mile. I estimated the value of the various interests then involved at their then market value at a little less than 1,000,000*l.* sterling, but which by a combination of interests and settlement of all disputes in law, and an indisputable title, would have doubled the value of the interests in less than six months after being carried into effect. And it would have been the largest and richest mining company in the world, as from out that area of ground there has been already obtained nearly 20,000,000*l.* sterling. The mines would have been more systematically and economically worked under one management, and a system of drainage introduced that would have prevented the flooding out of the alluvial workings, as is now the case, thereby stopping the development of the quartz lodes underlying the alluvial deposits.

The views I put forward from the first had ultimately to be adopted by some of the companies and sanctioned by the courts of law as the final and only solution of the difficulty created, but it was at too late a period to have the full effect as I desired and intended. When I first attempted to bring about an amalgamation the object I had in view was not only the concentration of interests under one system of good management; but when that had been effected the company could have become, as I intended it should be, bankers on their own gold, and the Australian Gold Bank would have been the wealthiest financial institution in Australia, with over 1,000,000*l.* sterling of new gold annually to work on, obtained from their own mines. Supposing only one-fourth of the gold raised had been reserved for banking operations the company would have created a capital in gold as a basis of financial operations of not less than 5,000,000*l.* sterling; and the profits of utilising only a portion of the new wealth the shareholders in the mines were daily producing would have created a permanent profitable interest in utilising the gold for future financial purposes as a banking institution, after the mines had, if they ever would in our time, become exhausted. This company would have been independent of outside capital or assistance, and merely required to coin a portion of their own gold and issue their own notes, on their own securities of gold and other properties. Such an institution, managed by intelligent men who knew and understood the requirements of gold mining, would have had a marked success and materially advanced the mining interests which it would have been their special care to encourage. My views on this question were highly approved of by many intelligent, thoughtful men, but the idea of utilising gold after raising it was not sufficiently understood at the time by my fellow-miners and citizens of Ballarat, although I see that they are now alive to the idea, and some of my old friends, whom I desired to co-operate with me nearly twenty years ago, have lately established a banking institution amongst themselves, which will, no doubt, be attended with success. It is by a combination of capital and labour, judiciously applied, that will advance the mining interest with more profitable results, but under the guidance of good management, enable many mines and districts now lying idle to be fully developed with profit and advantage.

Registration of New Companies.

The following joint-stock companies have been duly registered:—

BENNETT'S INTELLIGENCE ASSOCIATION (Limited).—Capital 20,000*l.*, in shares of 1*l.* To establish and carry on a general intelligence office, for the information of shareholders and the public. The subscribers (who take one share each) are—J. Trehern, Southgate; G. Burton, Mile End; G. F. Street, Lewisham; A. L. Rawles, 96, Newgate-street; A. Berry, Barnsbury; T. Masters, 54, Paternoster-row; G. F. Tucker, Brixton.

CAMM BROTHERS AND COMPANY (Limited).—Capital 16,000*l.*, in shares of 50*l.* To acquire and continue an established stone merchant's business at Brighouse, Yorkshire. The subscribers (who take one share each) are—W. Camm, Brighouse; A. Camm, Brighouse; N. Camm, Brighouse; J. T. Clay, Rastrick; J. W. Clay, Rastrick; A. T. Clay, Rastrick; W. A. Hutchinson, Rastrick.

JOHN BAZLEY WHITE AND BROTHERS (Limited).—Capital 1,000,000*l.*, in shares of 10*l.* To acquire and carry on a business of cement manufacturers and merchants, brick manufacturers and merchants, &c., established at Swanscombe, Kent, and elsewhere. The subscribers (who take one share each) are—L. White, 44, Onslow-gardens; F. A. White, Cromwell-road; J. B. Winn, Wilmington; T. Winn, Foot's Cray; H. S. Leonard, Lee; A. Grover, Swanscombe; H. Fuller, Stockwell-road; J. Austine, New Maldon; A. H. K. Ward, Holloway; R. E. Tyler, Upper Tooting.

THE LILBURN TOWER STEAMSHIP COMPANY (Limited).—Capital 50,500*l.*, in shares of 50*l.* The usual business of a steamship owner in all branches. The subscribers (who take one share each) are—J. R. D. Hickie, 127, Leadenhall-street; W. T. Betty, 21, Hyde Park Gate South; C. E. Hickthorn, 67, South Lambeth-road; J. Olive, 5, Fen-court; G. S. Tweedie, Lloyds; F. Stumure, 34, Leadenhall-street; D. Weston, 34, Leadenhall-street.

STEAMSHIP TROJAN COMPANY (Limited).—Capital 26,500*l.*, in shares of 100*l.* The purchasing, owning, and working of said steamship. The subscribers (who take one share each) are—S. Howicks, Standish; J. C. Sinclair, Liverpool; E. E. Broomhall, Liverpool; A. C. E. Harris, Birkenhead; T. J. Gillespie, Newton-le-Willows; E. C. Thin, Liverpool; L. E. Levy, Manchester.

THE ANGLO-ITALIAN RAILWAYS AND PUBLIC WORKS CREDIT COMPANY (Limited).—Capital 401,000*l.*, in shares of 20*l.* and 1*l.* To construct, purchase, maintain, and manage public works of all kinds, and to carry on the business of contractors, builders, mechanical engineers, brokers, merchants, &c. The subscribers (who take one share each) are—H. Sinnett, Hampstead; L. Vignaty, Rome; H. Fox, 28, St. Swithin's-lane; E. H. Wilson, 21, Lombard-street; R. Attenborough, Reading; J. Turner, 3, Great Queen-street; J. P. Houghton, Richmond.

THE TIMES MARINE INSURANCE COMPANY (Limited).—Capital 500,000*l.*, in shares of 10*l.* A general marine and other insurance business.. The subscribers (who take one share each) are—J. MacDiammid, Liverpool; A. M. Robinson, Liverpool; A. Bibby, Liverpool; D. E. Glynn, Liverpool; J. E. Anderson, Liverpool; A. M. Anderson, Liverpool; R. A. Job, Liverpool.

BRAZIL AND RIVER PLATE PUBLIC WORKS COMPANY (Limited).—Capital 200,000*l.*, in shares of 100*l.* To construct, repair, superintend, and maintain railways, tramways, harbours, docks, waterworks, gasworks, telegraphs, and other public or private works. The subscribers (who take one share each) are—R. G. Graham, 7, Finch-lane; W. Magnay, 18, Milton-street; T. Jervis, 68, Cheapside; T. Grover, 17, Devonshire-square; W. W. R. Burgess, 11, Sherborne-street; L. Bishop, 14, Belgrave-road; A. J. Davis, Hornsey.

HOTEL CONTINENTAL (Limited).—Capital 50,000*l.*, in shares of 100*l.* To acquire a property situate in Regent-street, and carry on the business of an hotel-keeper and restaurant in all branches. The subscribers (who take one share each) are—J. Jervis, Brixton; J. Robinson, Brixton; G. Rolfe, 46, Cannon-street; W. Y. Scruby, Acton; O. Reynolds, Acton; A. Wilson, 115, Hemingford-road; M. W. Thomas, 79, Lansdown-road.

THE ECCLES NEW ROAD PROPERTY COMPANY (Limited).—Capital 15,000*l.*, in shares of 5*l.* To carry on a building society's business in all branches. The subscribers (who take one share each) are—G. S. Ball, Manchester; F. Moss, Pendleton; J. Haynes, Salford; E. Whittaker, Salford; W. Haynes, Eccles; G. H. Taylor, Pendleton; F. H. Bagshaw, Pendleton.

THE STEAMSHIP WHINFIELD COMPANY (Limited). — Capital 24,650*l.*, in shares of 385*l.* 3s. 5½d. Purchasing, owning, and working said steamship. The subscribers are—E. J. Sutton, Newcastle-on-Tyne, 1; P. M. Brutton, Newcastle-on-Tyne, 1; J. K. Moffatt, Tyne Dock, 1; G. Milson, Felton, 2; J. Appleby, Harworth-on-Tees, 1; J. Hodgson, Darlington, 1; R. Cairns, Newcastle-on-Tyne, 1.

THE LONDON MUSIC PUBLISHING AND GENERAL AGENCY COMPANY (Limited).—Capital 10,000*l.*, in shares of 1*l.* To purchase and continue a business established at 180, Oxford-street. The subscribers are—T. Ward, 180, Oxford-street, 6; J. Kew, 6, Great College-street, 5; M. E. Schlesinger, 12, Chapel-street, 5; S. Allen, Holloway, 1; H. Brooks, jun., 61, Moorgate-street, 5; F. Trussell, 61, Mark-lane, 1; G. E. Brown, 32, Grove-road, 1; J. Watt, Kentish Town, 1.

THE CABMEN'S MUTUAL SOCIETY (Limited).—Capital 10,000*l.*, in shares of 1*l.* The general business of cab proprietors, jobmasters, livery and stable proprietors, &c. The subscribers (who take one share each) are—W. Griffiths, 47, Herbert-street; J. Grey, 111, Alderney-street,; G. D. Sandy, 3, Copthall-court; H. A. Mayes, 18, Poole-road; R. J. Rutter, Ludgate Hill; T. M. Ellis, 8, Old Jewry; J. Cox, 23, Percy-street.

ANGLO-HUNGARIAN MINERAL WATERS COMPANY (Limited).—Capital 50,000*l.*, in shares of 5*l.* Importers, exporters of, and dealers in mineral waters, and all natural and artificial remedies for the prevention and cure of disease. The subscribers are—H. Blumberg, Southport, 20; T. de Lenza, Southport, 20; J. Hodson, Southport, 20; J. Harry, Blackburn, 20; A. W. Field, Southport, 1; A. Carris, Liverpool, 1; G. H. Hyde, Liverpool, 1.

THE TRAMWAY AND PUBLIC WORKS CONTRACT AND MAINTENANCE COMPANY (Limited).—Capital 250,000*l.*, in shares of 5*l.* The subscribers (who take one share each) are—H. Wright, Birmingham; J. H. Smith, Bristol; A. E. Bunn, 8, Laurence Pountney Hill; A. E. Williams, 8, Laurence Pountney Hill; C. H, Nicholson, 8, Laurence Pountney Hill; J. P. Bowden, 8, Laurence Pountney Hill; T. Woodward, 98, Gainsford-street.

THE TROODOS HOTEL AND SANITARIUM COMPANY (Limited).—Capital 15,000*l.*, in shares of 10*l.* The establishing of an hotel and sanitarium in the Island of Cyprus, and maintaining same. The subscribers are—Rev. D. Arthur, Alexandria, 5; S. H. Carm, Alexandria, 25; J. C. Chapman, Alexandria, 25; A. Minotto, Alexandria, 50; L. Müller, Alexandria, 10; J. Barr, Alexandria, 5; C. Boyle, Alexandria, 2.

THE PALESTINE CHANNEL SYNDICATE (Limited). — Capital 10,000*l.*, in shares of 50*l.* To make all necessary researches, surveys, and arrangements for the construction of a ship canal or channel between the Mediterranean and the Red Sea. The subscribers are—Duke of Marlborough, 29, Berkeley-square, 1; Duke of Suther-

land, Stafford House, 2; Lord Clarence Paget, 7, Cromwell Gardens, 1; W. Mackinnon, Balinakill, 2; Sir H. Green, 93, Belgrave-road, 1; Sir A. B. Kemball, 5, Upper Belgrave-street, 1; Admiral E. A. Inglefield, 99, Queen's Gate, 1; Sir A. Borthwick, 60, Eaton-place, 1; J. F. Harrison, 41, Orrington-square, 1.

THE LADIES' TOILET ASSOCIATION (Limited).—Capital 10,000*l.*, in shares of 1*l.* The business of buyers, sellers, and dealers in all kinds of fancy goods, ladies' and other wearing apparel, &c. The subscribers are—J. G. Cook, 15, Ashmore-road, 1; R. Hodson, 108, Marylebone-road, 1; S. R. Wilson, Tottenham, 1; C. A. Forrest, Laughton, 5; J. H. Wells, Fulham, 1; J. H. Symonds, 23, Great Coram-street, 1; J. H. Marsh, Abbey-road, 50.

THE DIAMOND FIELDS AND MINES OF SOUTH AFRICA.

In an interesting paper read before the Institution of Civil Engineers, by Mr. J. N. Paxman, Assoc. M.I.C.E., at their last meeting, the author, after describing the position of the mines in Griqualand West and in the Orange Free State, remarked that in 1868 many enterprising colonists made their way up the Vaal River, and were successful in finding a good number of diamonds. The centre of the river diggings on the Transvaal side was Klipdrift, and on the opposite side Pniel. In all there were 14 river diggings. Dutoitspan and Bultfontein Mines were discovered in 1870 at a distance of 24 miles from the river diggings. The diggers took possession of these places. Licenses were granted giving the first diggers a right to work. In 1871 De Beer's and Kimberley Mines were discovered, and in 1872 Mr. Spalding's great diamond of 282½ carats was found at the river diggings. The mines were of irregular shape, and were surrounded by reef. The top reef was loose shale, and had given great trouble from the frequent slips. Below this were strata of trachytic breccia and augite; the formation was then seamy to an unknown depth.

Within the reef the surface soil was red and of a sandy nature. The next stratum was of a loose yellow gravelly lime, and the third blue, of a hard slatey nature. This last was the real diamantiferous soil. Large stones had been found in the yellow, but the working of this generally did not pay. Kimberley Mine, however, had paid very well all through. The first diggers treated on an average 10 loads per day each party. At the present time the least taken out by any engine when fully employed was 250 loads per day. The cost of working with present appliances the first 100 ft. in depth was 3s. 6d. per load; the second 100 ft. (mostly blue) 5s.; the third 100 ft. 8s., and the fourth 100 ft. 11s. Through scarcity of water a system of dry sorting had to be resorted to for several years; but it was superseded by the introduction of washing machinery, which was now generally employed. At the commencement, through inexperience, many serious mistakes were made. When the first diggers reached the bottom of the red sand, they thought no diamonds would be found in the next stratum. When, however, diamonds were found in the second stratum, the diggers had again to remove the debris, and so also when the "blue" was reached. Some of the claims in the Dutoitspan and Bultfontein Mines were irregular in shape. The other mines, however, had been properly and regularly laid out. One or two shafts had been sunk and connected with the mines by underground galleries. These galleries were convenient in the case of falls of reef. Labour, at first, was cheap; but from 20s. per month, wages rose to 30s. per week, and food. The yellow soil offered no difficulty in working, being loose and broken, but the blue soil required blasting. Several methods were adopted for extracting the soil and carrying it from the mine before steam was introduced. The cost of wood for heating purposes was a serious item, but good coal had now been found at 160 miles from Kimberley, costing 13*l.* per ton; another serious item of expense was the transport over natural roads only, costing from 18*l.* to 30*l.* per ton.

The machinery designed by the author for this industry was described. A 16 h.p. direct acting winding engine was introduced for hauling up loads at the rate of about 1000 ft. per minute; and a 25 h.p. geared engine for hauling up heavier loads at the rate of from 600 to 700 ft. per minute. In 1881 Mr. Paxman visited Kimberley and found the industry a large one, and no doubt was entertained but that it would last for over a century. It was believed that the main bed of diamonds had not yet been reached, and that the mines in operation were merely shafts leading to it. Now that the waterworks were finished, with a bountiful supply of water, coupled with the great boon of railways to the fields, and the advantage of a law recently passed for the prevention of illicit buying, a great and prosperous future was in store for the diamond fields.

FOREIGN MINING AND METALLURGY.

The tone of the Belgian coal trade has remained very good, especially having regard to the close approach of summer. There has been a slight fall in coke and coking coal, but the general aspect of affairs is very encouraging. The demand for industrial coal is active and prices have continued firm. The demand for household coal has fallen off a little in the Couchant du Mons, but this is usually the case at this period of the year, and prices have been easily maintained at an average of 10s. 5d. per ton, while the best descriptions have brought 12s. to 12s. 10d. per ton. The condition of the German coal trade has continued good and considerable exports are still being made. Belgium sustains an important part in these exports. Some important transactions are stated to have been concluded at prices which, if anything, show a slight advance. Deliveries of German coal to Italy have rather sensibly fallen off of late, and colliery owners are endeavouring in consequence to secure fresh reductions of tariffs on the St. Gothard Railway. It is stated that these efforts will be attended with success, and that a reduction of 2s. per ton will be made in the rates charged for the conveyance of coal from Westphalia to Chiasso and Luino.

Spring has not yet brought with it the revival in affairs which has been anticipated by some firms interested in the Belgian iron trade, which upon the whole, is still suffering from rather severe depression. Some works have still plenty of employment assured to them. It is even stated that several important orders have been received by certain rolling mills, especially in the Liége basin, but these orders, must, however, become much more general in order to secure any advance in quotations. English casting pig has been sustained with less firmness between 2*l.* 6s. 6d. and 2*l.* 7s. 4d. per ton. Belgian casting pig has been in comparatively little demand; it has maintained, nevertheless, a quotation of 2*l.* 18s. per ton at Charleroi. Luxembourg pig has brought 2*l.* 10s. per ton. The Athus-Helanzy group has maintained a price of 2*l.* 6s. per ton with firmness. As regards iron no reductions have been made in the rates current for No. 1 save in exceptional cases, but more or less important reductions have been made in the rates for higher numbers. No. 2 has been in comparatively little demand at 5*l.* 10s. per ton, while No. 3 has been rather weak at 5*l.* 16s. per ton. No. 2 plates have been maintained between 6*l.* 16s. and 7*l.* 4s. per ton. No. 3 plates have made 7*l.* 12s. to 8*l.* per ton. Merchants' plates 8*l.* 8s. to 9*l.* 4s. per ton, and No. 4 plates 10*l.* 16s. to 11*l.* 4s. per ton. The Haine St. Pierre Forges and Ironworks Company has secured an order for a pair of tubular boilers, intended to be placed in one of the Belgian Government mail steamers running between Dover and Ostend; the price to be paid for these boilers is 3016*l.*

There is a somewhat general slackening in production in the French iron trade; this reduction may be estimated at about 20 per cent. Thus, at a meeting of the forgemasters of the Nord, just held at Valenciennes, it was determined to work five days less than usual this month, so as to reduce the output. It is stated that the proposed establishment of a general warehouse for iron at Paris has been abandoned, many firms preferring to adopt the syndicate system instead. The idea is attended with rather considerable difficulties as regards the giving it practical effect, at the same time it is difficult to see why what is done for blast-furnaces could not also be realised for rolling-mills. The state of the Paris iron market is less satisfactory, and although several merchants still maintain their quotations for iron at 7*l.* 8s. per ton business might easily be done in merchants' iron at 7*l.* 4s. per ton. It is hoped, however, that the great French railway companies will shortly give out orders which will restore activity to affairs. The state of the German iron trade is not very brilliant, and the demand, especially for pig, appears to be falling off. Rolled iron has been in fair demand, but it has not been found possible to advance prices, in consequence of the abundance of offers. Much attention is being given in Silesia to a convention formed for the restriction of work in the rolling-mills; if this convention is not renewed or continued it is feared that there will be an excessive production, and by consequence a fall in prices. The German steelworks are still well employed, and a rather important adjudication has taken place at Magdeburg, contracts having been let for steel rails at from 7*l.* 1s. to 7*l.* 11s. per ton.

MINERAL RESOURCES OF BRITTANY—THE PONTPEAN MINE.

An evidence of what can be done with steady perseverance and sound practical management is afforded by the success which has attended the development of the Pontpéan Mine, near Rennes, in Brittany, and a brief reference to the reports of the last two years will not only be instructive, but may prove encouraging to many engaged in lead and zinc mining in this country. During the six years to the end of 1882 the thickness of the vein worked averaged 47 millimetres, 52 millimetres, 57 millimetres, 58 millimetres, 53 millimetres, and 76 millimetres respectively, and when it is remembered that there are 25 millimetres to the English inch, it will be evident that great care is required to work it at a profit, yet even 10 millimetre veins are not neglected, even when they are met with in lodes from 3 ft. to 5 ft. wide. During last year the mines gave employment to 291 men, who raised on the average nearly 66 cubic metres per head, which is the highest for several years past, the figures for 1881 showing only just over 60 cubic metres per man per annum. The ore broken in 1882 was 15,022 cubic metres against 13,503 cubic metres in the preceding year. The starting of the new pumping-engine enabled them to extend their operations, and moreover the fall in the price of metals compelled them to push on as fast as possible. They dressed during the year 41,119 tons of stone, which yielded 4912 tons of lead ore, 2260 tons of zinc ore, 534 tons of pyrites, and 375 tons of schlamms, making 8081 tons in all, showing an increase of 1242 tons of lead ore and 775 tons of zinc ore as compared with the preceding year.

The manner in which the details are given by the indefatigable managing director—Mr. Charles Eloy—enables every shareholder to see that ample attention is given in every department, and the facilities offered for comparing the results of several years with each other permits of a ready check upon all employed. The amount paid for dressing in 1882 was 143,966 frs., which gives 17·82 frs., or 14s. 5d. per ton of ore, against 21·53 frs., or 17s. 3d. in the preceding year. The ore treated was slightly richer in lead, and poorer in silver, the contents being 52·34 per cent., against 50·51 per cent. of lead and 884 grammes, against 997 grammes of silver per ton of ore. The silver per ton of lead was 1·688 kilog. in 1882, against 1·973 kilog. in the preceding year. The diminution in the produce for silver which continued in 1882 did not, in Mr. Eloy's opinion, seem to be the consequence of depth, but of accidental variations in the richness of the vein, which contains galena of varying produce for silver, from 200 to 3000 grammes per ton of ore. With regard to the commercial results of the year's operations, Mr. Charles Eloy had good reason to congratulate the shareholders who were present at the recent meeting (April 24) upon the success achieved, which permitted of the payment of a dividend of 15 frs. (12s.) per share, against 7·50 frs. in the preceding year. The Pontpéan Mine has long yielded satisfactory interest to the shareholders, and under the present energetic management appears likely long to continue to do so.

THE MINERAL RESOURCES OF NEW ZEALAND—COAL.

An excellent historical sketch of the discovery, settlement, and physical features of New Zealand is contained in the elaborate paper recently read before the Liverpool Geological Association by its President,—Mr. Henry Bramall, M.I.C.E.—and forms a very suitable introduction to the account of the mineral resources of the province, which it was the chief object of the author to describe. It appears that nearly the complete geological sequence of formations known in Europe has already been identified in New Zealand, the gaps remaining to be filled being chiefly in those archaic rocks found in the mountainous, almost unknown, and scarcely accessible regions of the south-west; these are, at present, but roughly grouped, chiefly from their mineralogical characteristics. It is noticeable that the general strike of the rocks of the older formations has a north-easterly and south-westerly direction, which, as Dana points out, corresponds with the line of elevation in the Pacific Ocean, the same general effect being observed on the east coast of Australia. This line of elevation also corresponds with the general lines of Plutonic and volcanic outbursts, which extend along the eastern foot of the mountain ranges of the South Island and the western foot of those of the North. It is crossed, nearly at right angles, by a line of depression, originating the transverse ruptures to which are due Foveaux and Cook's Straits and the north-east coast line of the North Island. The important part played by volcanic agencies in the formation of the country is seen in the tufaceous breccias and lava flows, which cover so large a part of the surface; fully one-third of the area of the North Island being occupied by these deposits. And that these forces are even now not quite extinct is evidenced by the smouldering cones of Ngarahoe and White Island and the hot springs of the Geyser district; while old Vulcan, by an occasional gentle earthquake, reminds the inhabitants of his near presence. The mineral resources are rich and varied, and though as yet but imperfectly explored, as we may easily suppose when we remember that the country is as large as Great Britain, and the population less than that of Liverpool; still, enough has already been discovered to indicate the future development of immense wealth. In the following notes no attempt will be made to treat systematically of the mineralogy of the country, but those minerals only will be noticed which are of commercial importance.

No true palæozoic coal has yet been found in New Zealand, all the seams known are of late mesozoic or tertiary age, and of the kind usually termed by geologists brown coal; yet the varieties of quality range from lignite, but little removed from peat, to coal, which in appearance and composition cannot be distinguished from true anthracite, these variations chiefly resulting from purely local causes, such as the contact or proximity of volcanic dykes or flows, which have deprived the hydrous coal of more or less of their water. The varieties may be roughly classed as lignite, woody structure, with 15 to 30 per cent. of water; brown coal, compact structure, with 10 to 20 per cent. water; pitch coal, conchoidal fracture, water usually under 10 per cent.; bituminous or coking coal, laminated and cuboidal, water less than 5 per cent.; and anthracite, very dense and compact, practically anhydrous. The principal coal fields are—the North Auckland coal field, which extends from south of Wangarei to near the Bay of Islands, a distance of more than 30 miles. The field is bounded on the east by palæozoic slates and sandstones, and in the hollows of these rocks lie the beds of the cretaceo-tertiary formation, at the base of which are the coal seams. Near Wangarei Harbour these beds cover an area of about 16 square miles, with two seams of coal, the upper 4½ ft., and the lower or main seam 6 ft. to 10 ft. thick. The coal is pitch coal, of good quality, and is worked at the Whau-Whau and Kamo Collieries. At Kawa-Kawa there are two seams of coal, the upper 4 ft. 3 in. thick, of inferior quality; and the lower or main seam from 6 ft. to 15 ft. thick, pitch coal, hard, compact, and of good quality; this is now worked by the Bay of Islands Coal Company. The total area of this basin is estimated at 10 square miles. Small deposits of brown coal have been found at several points of the Coromandel peninsula, and quite recently a bed of excellent bituminous coal is reported from Tiaroa. As to the South Auckland or Waikato coal field it appears that so far back as 1859 a coal seam about 6 ft. thick was opened at Drury, 20 miles south of Auckland, but the coal was inferior, crumbling on exposure, and the irregular floor of clay, bad roof, and costly freight, caused the works to be abandoned after four or five years, and they have since remained closed. The coal basin of the lower Waikato extends from Mercer southwards to Taupiri about 35 miles, with a breadth of probably about 20 miles

South of the Waikato field, on the River Mokau, outcrops of seams 2 ft. to 6 ft. thick have been examined by Dr. Hector, who reports them to be pitch coal of good quality, and probably of lower greensand age. The densely wooded nature of the country, which is in the hands of the natives, prevented the extent of the outcrops from being traced, but these were found at several miles apart. Brown coal has been found in the province of Wellington on the Wanganui and Rangitikei rivers. The Nelson or West Coast coal fields in the South Island are perhaps the most important in the colony. They occur as detached deposits in the hollows of the older rocks, and extend from West Wanganui to Grey river, about 150 miles. At several points in the vicinity good outcrops are known. At West Wanganui inlet a 4-ft. seam has been worked, but unsuccessfully. The Buller coal field extends from the Mokihinui to the Buller, about 40 miles, with a miximum breadth of seven miles. The country is broken and rough. The quality varies in different parts from a tender bituminous coking coal to a splint or Cannel coal. Several attempts have been made to work this field, but not with very satisfactory results; recently, however, the Westport Coal Company has opened a colliery which gives good promise. The quantity of coal available is estimated at 105,000,000 tons. The Grey coal field, about seven miles above the mouth of the River Grey, extends about 15 miles north and south. There are several seams, the principal one being 12 ft. to 16 ft. thick of bituminous coking coal, overlaid by sandstones and having a fire-clay seat. This coal is probably the best gas coal in Australasia. This field is estimated to contain about 4,000,000 tons of available coal. Reefton is a gold mining town on the Inangahua river, east of Grey, where seams of pitch coal from 6 ft. to 21 ft. thick are found, and worked on a small scale for local use. Some brown coal beds found at Nelson City have led to many unsuccessful attempts to work them; and at Picton also many trials have been made which ended in disappointment. At Kanieri some coal crops are found which have led to considerable sums being spent in prospecting trials, but no payable seams have been proved.

The Malvern Hills coal field, about 30 miles west of Christchurch, comprises a district of about 180 square miles. The beds of the great brown coal formation lie along the east slopes of the hills, and descend towards the plains, beneath which they appear to dip. They consist of sands and shales, with several seams of coal, the thickest of which, however, is only 7½ ft. The district has been extensively disturbed and broken by dykes of trachytic porphyry, and subsequently subjected to enormous denudation. There are several collieries working in this field, and the whole available coal is estimated by Dr. Haast at something under 5,000,000 tons. At Client Hills and Mount Somers are coal seams, but they are of purely local importance. At Oamaru there are two seams of brown coal each 9 ft. thick worked on a small scale. The coal measures at Shag Point flank the horse ranges, and consist of several thousand feet of conglomerates, sandstone, and shales. The uppermost beds of the series extend about 1½ mile along the coast by about ½ mile wide, and contain valuable coal seams estimated to yield about a million tons, and which are seen outcropping in the precipitous cliffs. The Shag Point Colliery works a seam of pitch coal 7 ft. thick, which is followed to the deep under the sea. Green Island coal field, near Dunedin, has an area of about eight square miles. There are five seams, but only one is worked, varying from 13 ft. to 19 ft. in thickness, of inferior hydrous brown coal. The roof is bad, so that only 7 to 10 ft. of the seam is worked. There are five collieries, and the contents of the field is computed at 28,000,000 tons. The Clutha and Tokomairiro coal field covers about 40 square miles. The seam worked at Kaitangata is from 24 to 30 ft. thick, of which from 20 ft. to the full thickness is got. The field is estimated to contain 150,000,000 tons. In Southland and the south and west of Otago a considerable extent of surface is occupied by beds of the cretaceo, tertiary, and jurassic formations, and outcrops of coal have been found at many points, but the seams have mostly been too thin for profitable working. At the Nightcaps, Otautau, a seam of pitch coal 5½ ft. thick is being got on a limited scale, and at Mataura lignite 12½ ft. thick has been worked for some years.

Lignite deposits are found in many parts of Southland and Otago. Usually they occur in what are evidently old lake basins, in the surface of the slate rocks in the interior. They are often of great thickness, and owe their origin to driftwood; fragments of trees are common in which the woody tissue is perfect, the most usual being a species of fagus, the "birch" of the colonists. The lignites not uncommonly contain resinous matter (retinite) in considerable quantity, when they burn very readily; where this is absent, or only present in very limited quantity, they burn slowly, smouldering like turf, giving off a disagreeable fœtid odour, and leaving a large quantity of light ash. They are worked at numerous points, usually as open-casts, and on a very limited scale, and, where better fuel is scarce and costly, they prove very useful for local requirements. It will thus be seen that coal seams are widely distributed through both islands, and no parts except the east of the North and the north-east of the South Islands are very distant from workable coal. A noteworthy point, as compared with British coal fields, is the limited vertical depth of measures to which good coal seams are confined; and most of the areas contain only one good workable seam. As to the quantity and duration, it appears that in known areas an available supply of 450,000,000 tons has been ascertained. Any computation of the duration of this supply would, in the present state of the colony, be little more than a wild guess. The local consumption of coal in 1881 was, in Great Britain, 3·67 tons, and in New Zealand ·86 tons per head of population. But the increment in population and the development of industries in the two countries are so dissimilar as to preclude our founding any estimate on this basis.

With regard to the quality of the coal, it is remarked that, though all the coals of New Zealand are of comparatively recent age, and might be termed brown coals, in various states of alteration, yet the qualities are very various. The ownership is with the freeholder, as in England, and in these cases the owner may either work the mines himself or lease them on such terms as may be agreed upon. In some instances the coal fields have been treated as reserves, and the Crown will grant the right of working the mines subject to royalty, reserving a small fixed rent, and granting the use of surface land for the erection of the requisite works. The Government has expended large sums in aiding the adventurers to search for and open mines and in making railway and other works. The coal trade of the colony is yet struggling in its infancy, and one of its greatest difficulties would seem to be the want of better means of communication, more and better roads, more and cheaper accommodation by rails, improved harbours and ports, with specially-built steamers by sea. It certainly is curious that, with such splendid resources at their feet, the colonists should be content to receive so large a part of this prime necessity from their neighbours; and it is an anomaly to which they would do well to bestir themselves to put a speedy end.

DUNCAN'S TRAMWAY MANUAL.—The new annual edition—that for 1883—of the "Manual of British and Foreign Tramway Companies," compiled by Mr. W. W. Duncan, stockbroker and tramway sharedealer, has just been issued through Mr. Effingham Wilson, Royal Exchange, accurately corrected, as usual. Mr. Duncan remarks that tramway property has been to a certain extent under a cloud during the past year or two. There have in some instances been mismanagement, but the chief reasons have been continuous unsettled weather and very dear provender. The latter cause will not at any rate affect them this year, and altogether he thinks the prospects before the various companies are deservedly brighter. There has been great disappointment in the result of working by steam-power so far, the expenses having been greatly added to by the requirements of the Board of Trade. Experiments are being made with an electrical motor, but as yet they are not enough advanced to prove how far they are likely to come into practical use and be beneficial to tramway interests. Referring to the Hallidie wire-rope system worked by a stationary engine, Mr. Duncan says that in hilly districts where there is a continuous traffic a great saving can be made by adopting it, but it is too expensive for tramways in ordinary localities. The manual contains all the facts relating to tramways likely to be required, and is arranged for recording and comparing the traffics from week to week. It is in all respects worthy of commendation"

MINING MACHINERY—WATER-JACKET FURNACES.

Although where an industry is to be permanently established the substantial erections common in Europe can scarcely be surpassed either for durability or for working results, it is recognised by all practical men that in comparatively undeveloped countries and in districts where sufficient experience has not been gained to permit of an accurate judgment being formed as to the precise locality which is most likely to become the centre of operations, a lighter and more quickly erected construction has many advantages. In the design and manufacture of this class of machinery and working plant the Americans are certainly in advance of most other nations, the Australians probably following next in the order of merit. In connection with practical metallurgy the system of water-jacket smelting-furnace, which has been somewhat largely introduced in America, has permitted of extensive smelting operations being commenced in a time and at a cost which in old countries would have been considered so small as to be practically unattainable. An entire apparatus or machine is delivered on the spot where it is to be used in such a state that it can be fitted and set to work in a time that would formerly have been consumed in getting the workmen together to perform the labour. The chief seats of manufacture of this class of machinery are San Francisco and Chicago, Messrs. Rankin, Brayton, and Co., of the former city, and Messrs. Fraser and Chalmers and Messrs. Carlisle Mason and Co., of the latter, being amongst the most prominent firms.

The Pacific water-jacket smelters, which are made by the San Francisco firm just mentioned, are designed for galena and for copper ores, and in both applications appear to have been decidedly successful. It is claimed that the Pacific galena-silver smelter as now constructed embodies the results of more than twenty years' experience, observation, and study as to the requirements of this method of treating ores, and that the remarkable results obtained from it regarding capacity for continuous work, minimum cost of repairs, and economic production of bullion, fairly entitle it to be considered as the most improved type of smelter now in the market. The water-jacket is made in sections—two or four according to size, so that any of them can be removed without disturbance to the rest of the furnace, making all parts accessible for cleaning out and repairs when necessary. With a large plant extra sections may be provided, which can be quickly put in place in case of leakage or accident to one of them, thus securing against any loss of time in running. The jacket is made of wrought-iron, and can be easily repaired in case of leakage. Cast-iron jackets are heavy for freighting, liable to crack, and are then worthless. The whole structure is made complete at the shop—constructed mostly of wrought-iron, to insure strength and lightness, and in sections to facilitate transportation and setting up, no brickwork being required, except for crucible and two courses on top of jacket, making the cost of erection less than half that of any other styles of smelters. One of the most important features in the apparatus is the series of circulation plates which are put into each section of jacket in such a way as to secure a rapid circulation of water. This prevents any scale from forming on the inner surfaces of the plates from the action of mineralised water, reduces the temperature, and prevents the overheating and burning out so common in all other jackets. This device also causes the heat to be evenly distributed, and thus prevents unequal expansion and contraction, which is largely the cause of leaky joints. Experience has shown this to be a most valuable improvement, adding at least two or three times to the effective wear and service of the jacket, besides saving in loss of time and cost of repair. The use of these plates also saves at least one-half the water required in other jackets—a point of much importance in localities where water is scare.

The whole apparatus is at once compact and substantial, a boiler foundation and curb being provided, inside of which the whole structure is built. This is to prevent any escape of bullion in case of leakage from the crucible, which often occurs, involving serious loss without any means of detecting it. Instances have come to our knowledge where large sums have been saved in this way. The lead-well is located outside the jacket, into which the metal is run and kept hot by a small fire, while the dross and other impurities can be skimmed off before being ladled into moulds. The tuyeres are made in the jacket, and, being surrounded with water in active circulation, never burn out. The jackets are retangular in form with round ends, giving no corners for the accumulation of slag, which tends to bridge the ore and prevent it from coming in contact with the blast. The arrangement of the tuyeres and the distribution of the blast are such as to avoid dead centres, secure perfect combustion, and the most economical results from fuel. In the larger sizes both ends are provided with charging doors and slag discharges. The smelters are made of from 10 to 40 tons capacity, the larger sizes being, when the supply of ore warrants their erection, more economical both in fuel and attendance, and they are said to be equally adapted to all classes of galena ores whether free or base, the successful working of which being merely a matter of fluxing. With single stacks separate engines are provided for blower and crusher to insure a steady blast. In larger plants a Wheelock automatic cut-off engine is recommended with power for all requirements. Downcasts with steam or water jets, to condense vapours and save fine dust, are furnished when desired, or stack arranged for a flue condenser. The great drawback to the successful treatment of ores by the smelting process, it is well known, has been the want of a smelter that could be run continuously without stopping frequently for repairs, two stacks being ordinarily required to keep one in constant blast. This difficulty has, it is said, been overcome in the present smelter, which, with the care ordinarily given a steam-boiler, can be run as long and with as little loss of time or expense for repair.

A corresponding principle is adopted in the Pacific copper smelter, but the form and details of course differ from those of the galena smelter. It is remarked that no class of mines in all the great Mineral Belt are now attracting so much attention as those of copper, and improved appliances for reduction have, therefore, come to be a matter of the first importance. But a few years since the only process known for the reduction of copper ores was the reverberatory furnace, which was expensive as to first cost, as well as to operate and keep in repair, slow in action, and uncertain in results. The water-jacket smelter has revolutionised the business of smelting, and made practicable the treatment of copper ores in all their various combinations by a smelter simple in its operation, comparatively inexpensive, and which can be run continuously without loss of time or expense for repairs, giving in all instances the best product obtainable at the smallest possible cost of fuel and attendance. Stimulated by the success that has attended this manner of reduction a large number of very valuable copper mines have already been opened, and are now being operated with great profit, while exploration and development continue in all parts of the country with the most encouraging results. Large numbers of these smelters are now running in nearly every mining State and Territory, quickening all avenues of trade, and turning out a stream of bullion that is enriching the country as well as the parties more directly interested. The whole structure is complete as its leaves the works, ready to set up, requiring no brickwork, except a few courses for forming the crucible, and can, therefore, be put up ready for operation at small cost, and in a few days' time. The jacket is made of heavy flange iron of the most enduring quality, and with much more care than is ordinarily given to any class of boiler work. Circulating plates similar to those used in the galena-smelter are used, and this by leaving no spot within the water space where the water is not in constant and rapid motion, causes the heat to be evenly distributed throughout the whole jacket, and thus prevents unequal expansion and contraction, and consequent leaky joints. The motion of the water also prevents any scale or sediment from depositing on the surfaces, and in this respect is of great advantage where water used is highly mineralised. The arrangement of tuyeres is such as to secure a perfect delivery of blast to every part of the charge, producing a uniform melting area throughout its entire section, thus obtaining rapid action of the furnace, great economy of fuel, and preventing any tendency to freezing. The tuyeres, being entirely within the water-space of the jacket, are wholly protected from the action of heat, and, consequently, never burn out or become a source of trouble. Peep-holes, with removable cap and mica covering, are arranged opposite each one, so the processes going on inside the furnace can be constantly observed. The crucible is formed on a bottom, hinged to the plate, that can be instantly dropped when any obstruction occurs, or for access to the interior when repairs are necessary. The economy and facility with which these furnaces are operated makes it possible to profitably reduce ore of a much lower grade than has hertofore been thought possible, and, consequently, the field for such enterprise has been greatly enlarged.

In practical use these water-jacket furnaces seem to have given general satisfaction, the numerous certificates given by the furnace superintendents in works where they have been adopted being unequivocal. Thus Mr. Lewis Williams of the Copper Queen Mining Company's Works after running one 30-ton smelter for 16 months, and a second of the same capacity for four months certified that they put through each something over 30 tons per day exclusive of flux, and that the average bullion product of the two furnaces was over 11½ tons per day running from 96½ to 98 fine. The slag when the furnaces are running properly shows a loss of less than 0·5 per cent. from the assay value of the ore. Mr. Williams adds that "on account of the scarcity of timber for making charcoal in our locality we use coke for fuel—mostly English—though we have occasionally used the New Mexico Trinidad in connection with it. To illustrate the facility with which these furnaces can be managed, I would state that in several instances, when our coke supply has come short I have banked the fires for several days at a time, and started the stream of bullion again in 15 minutes after putting on the blast. These furnaces are adapted to any class of copper ores, are simple in construction, easily handled, and with proper care are always in order. I have had more than 20 years' experience in copper smelting, and have never seen a furnace that can compare with yours for reliable, effective, and economical work—in fact, I know of no other furnace now made that will handle successfully the copper ores of our mining States and Territories." An equally encouraging account is given by Mr. W. P. Miller, superintendent of the Castle Dome Smelting-Works, California, who writes that he regards the circulating plates as the most important improvement ever made in water-jacket furnaces, and worth more than the entire cost of an ordinary jacket. There is no question, he continues, but that a jacket for either galena or copper ores with this improvement "will last two or three times as long as without it, besides lessening the liability to injury and the consequent expense and loss of time for repairs. Since the adoption of this improvement I have had no trouble whatever with my jackets. The circulation of the water is so rapid that the inner surfaces of the plates are kept scoured and entirely free from any incrustation, and it seems to afford perfect protection from the effects of mineralised water, and from the over heating and burning out so common in other jackets." It must be obvious to directors and shareholders as well as to engineers engaged in working foreign mines with British capital, it is the adaptation of machinery and apparatus to the particular circumstances of the case in hand that makes the difference between gaining and losing, and if water-jacket furnaces really possess the advantages claimed for them their adoption should at least have thorough consideration.

MINERAL GROWTH.—An extraordinary specimen of chemical growth upon a mineral was exhibited at the recent meeting of the South Staffordshire Institute of Mining Engineers by Mr. Henry Johnson, of Dudley, who remarked that 40 years ago he picked up a mineral in the ordinary form of iron pyrites, and for the last 25 years it had been developing a sulphurous growth, which had yearly faded away, and as regularly returned. It had increased in bulk every year, and by its action had destroyed plates and eaten through cabinets. Eminent chemists in various parts of the world had seen it, but had not been able to fully account for the phenomenon. The exhibitor expressed his willingness to show the specimen to any chemist or mineralogist who felt an interest in inspecting it. The specimen was then examined with much curiosity.

** The TITLE-PAGE and INDEX to VOLUME LII., for the year 1882 was published in the *Mining Journal* of Jan 20.

ORE CRUSHING AND AMALGAMATING MACHINE.

In the preparation of ore for market the economy of the crushing and amalgamating processes usually determines whether the final result will be a loss or a profit. Mr. Sigismund Wekey, of Catherine-street, has therefore designed an improved machine, which consists of a lower part or disc of cast-iron having circular concentric grooves, the outer edge of each groove being a little higher than its inner edge, so as to allow the crushed material, sludge, or tailings to pass inwards, and towards the opening for the outlet of the sludge and tailings at the central part of the machine. This lower disc has a water-pipe round the outer edge of the first groove, the inner side of which pipe is perforated with small holes to allow water to flow into the outer groove when the machine is in operation. On the bottom of the three parallel grooves there are small holes, closed with movable plugs. These small holes communicate with an inclined channel passing through this lower disc; this channel terminates in a tap, which is to serve the purpose of draining the amalgam and quicksilver from the machine when required so to do. In these parallel grooves there are hard chilled iron balls; by means of these balls the crushing of the ore placed into the machine is effected.

The upper part of the machine consists of a second or upper disc. The under surface of this disc has circular concentric grooves, corresponding with the grooves of the lower disc. On the inner surface of this upper disc there are also projections to propel and separate the balls in the machine, the one ball from the other. Thus constructed this upper disc rests (or revolves when required) on the balls in the grooves of the lower disc. The outer periphery of this upper disc is cast with teeth, into which a driving wheel and pinion gear. The outer surface of this upper disc has compartments for the purpose of holding stones, iron, or any other heavy substance, which being placed into these compartments increase the weight of the upper disc and the crushing power of the machine. This upper disc is kept in place by means of a perpendicular upright shaft. Near the outer edge of this upper disc there is also a groove with a pertures at distances, and the ore is placed into this circular feeder by hand or by other means. The ore falls down through the apertures into the outer groove of the machine, and there is crushed by the balls upon which the weighted upper disc revolves.

The working of the machine is very simple. Gold ore is supplied into the circular feeder of the upper disc. The machine is put in motion by means of horse, steam, or water power, and the operation of crushing the ore and amalgamating the metal is commenced. Whenever the contents of the machine—the amalgam and quicksilver—is to be removed, the upper disc may be lifted by means of a screw jack, the plugs of the small apertures in the bottom of disc are lifted, and the amalgam and quicksilver are allowed to flow down the inclined channel into any convenient receptacle, to be then resorted and treated in the usual manner. This machine may be used alone and without any other auxiliary appliances such as are used in connection with stampers—Chilian mills, Tyrolese amalgamators, shaking tables, amalgamating tables, and a variety of other contrivances to pulverise the ore, and to amalgamate the gold set free from the rock by crushing it, and subsequently to wash the concentrated sand in dishes to collect the amalgam of gold and quicksilver. Without in any way interfering with the contrivances actually in use for crushing the ore and amalgamating the gold, this machine may be used to save a large quantity of fine gold and quicksilver which is now invariably lost with the sludge and tailings, on account of the imperfect appliances hitherto in use for crushing and amalgamating gold ores and the gold it contains.

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